SEPTEMBER 1961

Heating Piping & Air Conditioning

. . . for Consulting Engineers
Mechanical (HPAC) Contractors
Engineers with Plants & Buildings

How to Determine Cooling Loads
. . . page 111

Tables to Help You Calculate Piping Installation Costs
. . . page 103

Air Conditioning Stabilizes Missile-Tracking Antennae
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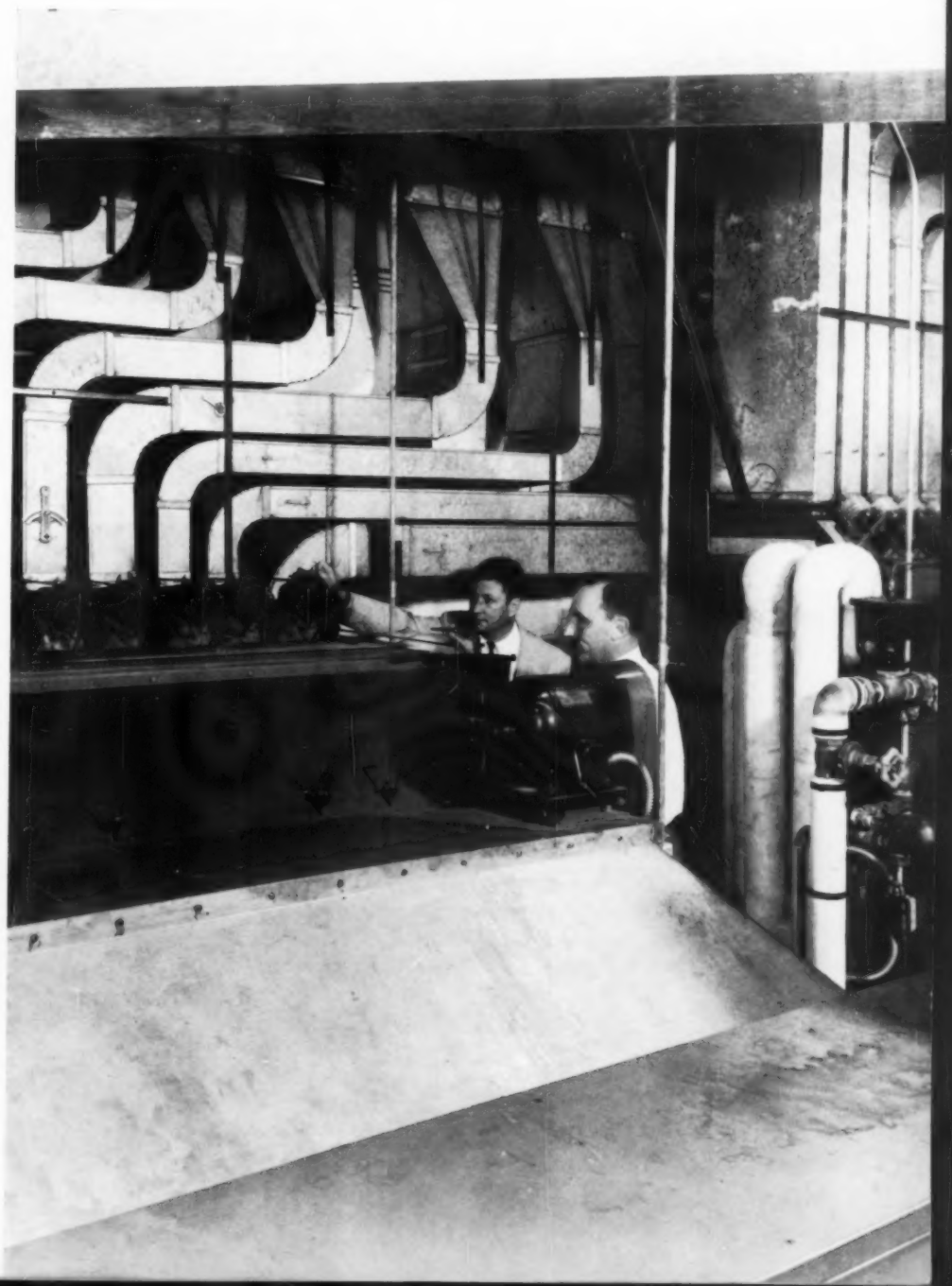

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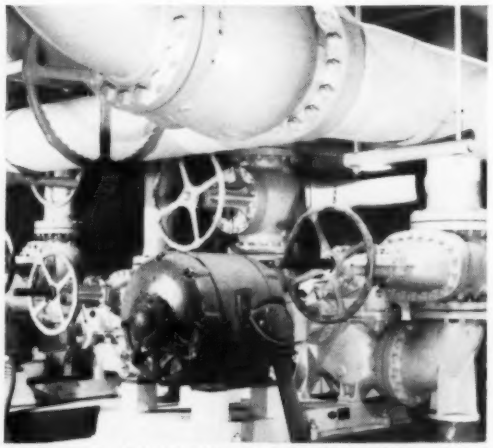

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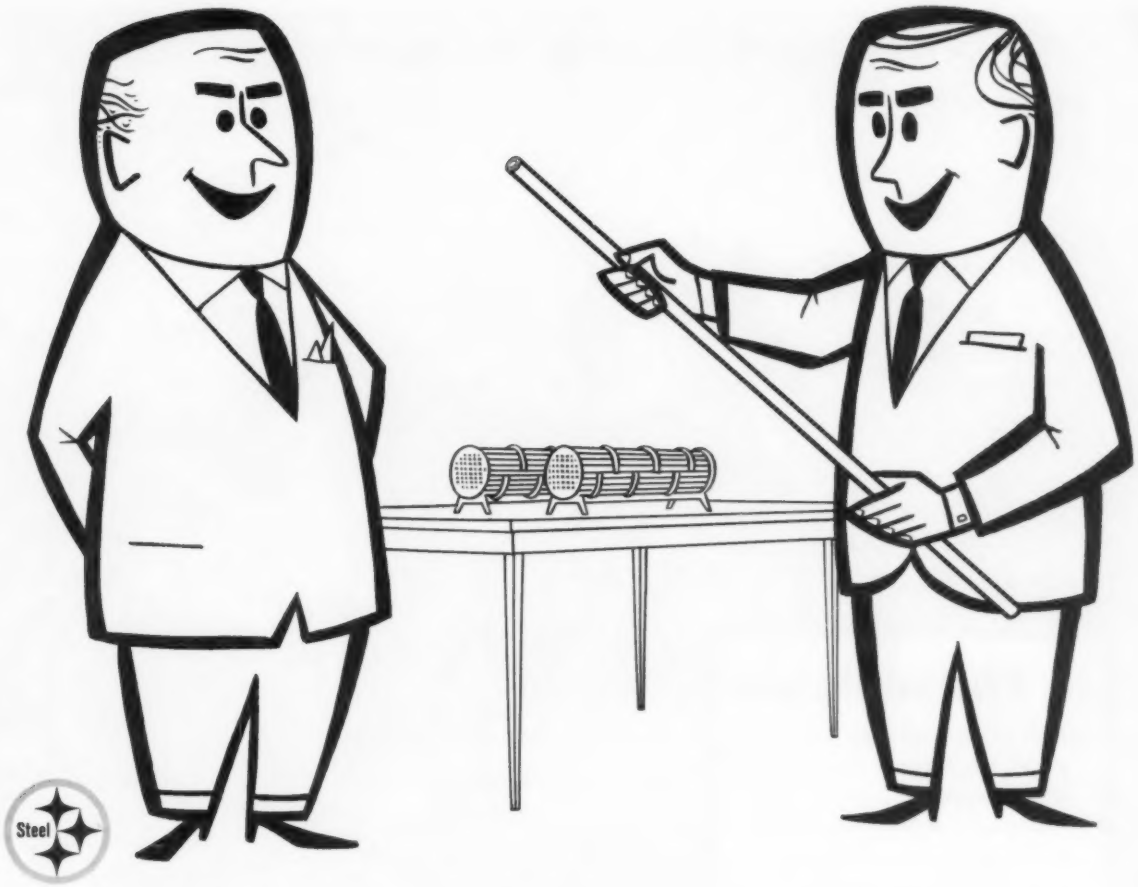

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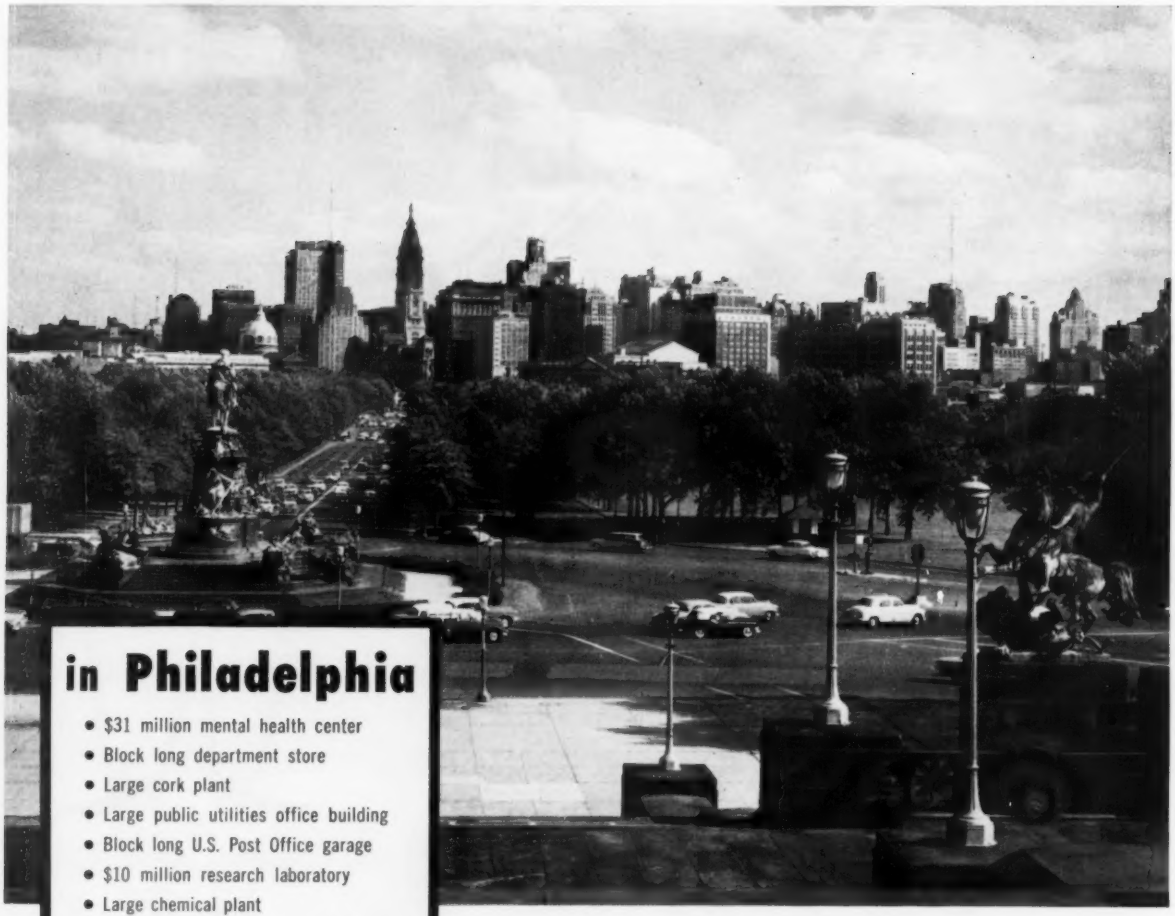

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Heating, Piping & Air Conditioning

FOR CONSULTING ENGINEERS, MECHANICAL (HEATING, PIPING, AND AIR CONDITIONING) CONTRACTORS, ENGINEERS WITH PLANTS AND BIG BUILDINGS

VOL. 33, NO. 9 SEPTEMBER 1961

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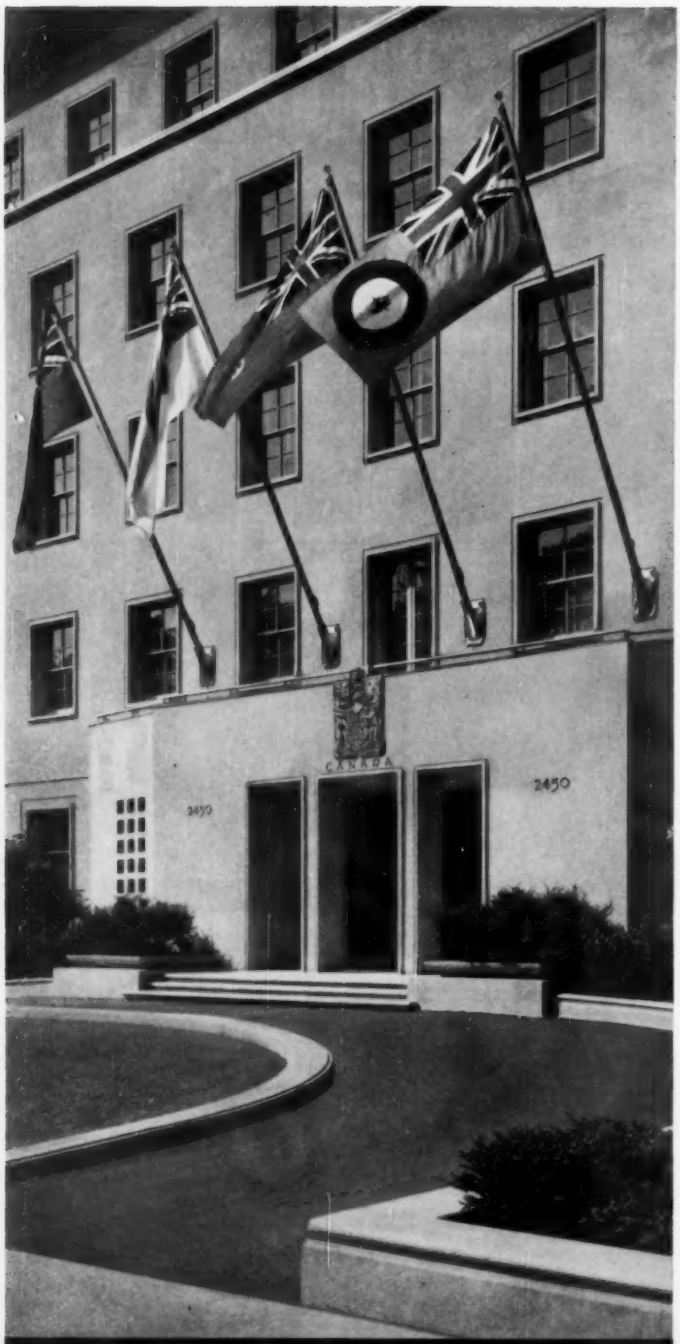

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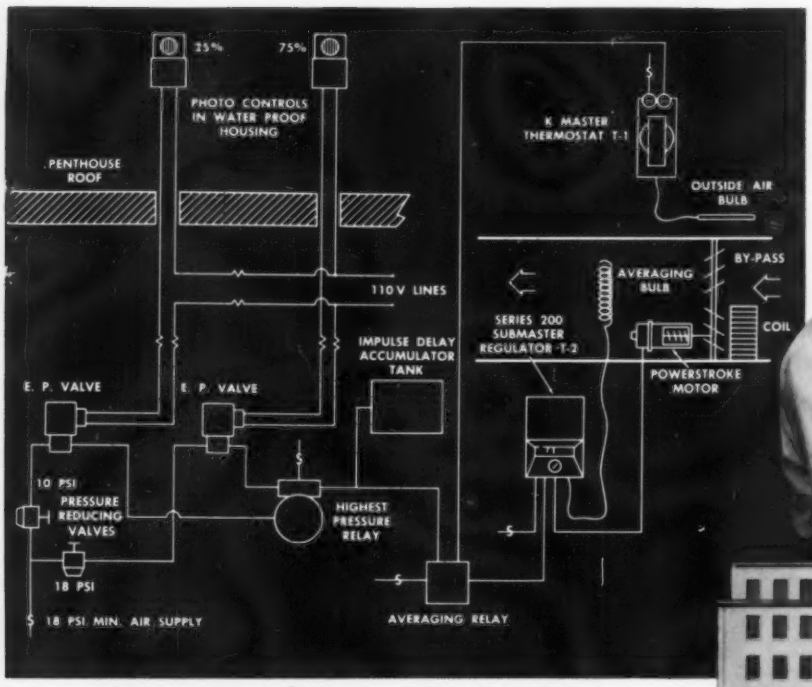
Faulkner, Kingsbury & Stenhouse, Washington, D.C.

Consulting Engineer:
Charles S. Leopold, Inc., Philadelphia, Pa.

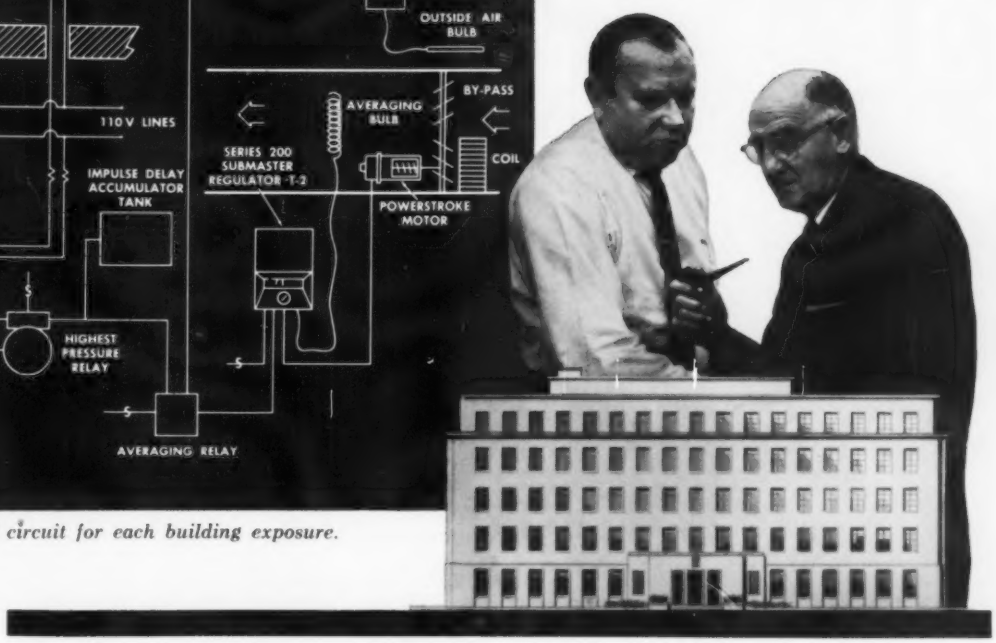
HOW TO SAVE COOLING DOLLARS WITH SUNPOWER

Consulting Engineer, Charles S. Leopold, confirmed his reputation for imaginative engineering when he put the sun to work in the air conditioning system of the Canadian Joint Staff Building, Washington, D. C. As a result, the occupants enjoy year-round comfort.

The Powers SOLARTOL, an electronic-pneumatic system designed to measure solar intensity and regulate air conditioning systems accordingly, is used to accomplish this.



Solartrol control circuit for each building exposure.



G. Titus Fenn, chief designer, and Charles S. Leopold.

HOW IT WORKS—Four pairs of photo-electric cells are mounted on the roof, each pair measuring the solar radiation falling on one side of the building which is oriented 45° from the true north-south. They are connected to submaster thermostats that control conditioned air temperature for each exterior zone in the building. One cell of each pair is set to operate at 25% Solar Gain and the other at 75%.

With no sunlight, an outdoor-air master-thermostat regulates the conditioned air temperature. As outside temperature rises from 78° to 95°, the zone air supply controls reset through a range of 68° to 63°.

With 50% Solar Intensity, the thermostat controls for that particular building zone are adjusted to operate at a 5° lower temperature range — 63° to 58° — to compensate for the additional heat of the sun.

With 100% Solar Intensity, the zone air supply controls are adjusted to operate at a still lower temperature range — 59° to 54°.

By varying the temperature of the air in the zone duct according to solar intensity as well as outdoor temperature, the final room controls operate more accurately. Equally important is a definite economy of refrigeration.

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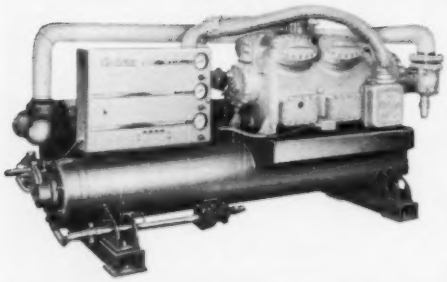

Carrier 30A Package incorporates a hermetically sealed motor compressor, a condenser, a two-circuit direct expansion type cooler with ¾-inch flexible closed cell foamed plastic insulation, filter dryer, moisture indicator, liquid line sight glass, crankcase heater, thermal expansion valves, starting equipment and controls, interconnecting wiring, and refrigerant piping. Model 30B packages are essentially the same but condenserless.

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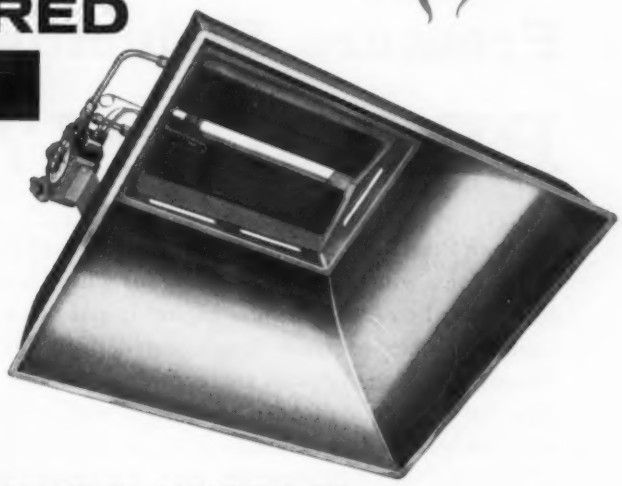

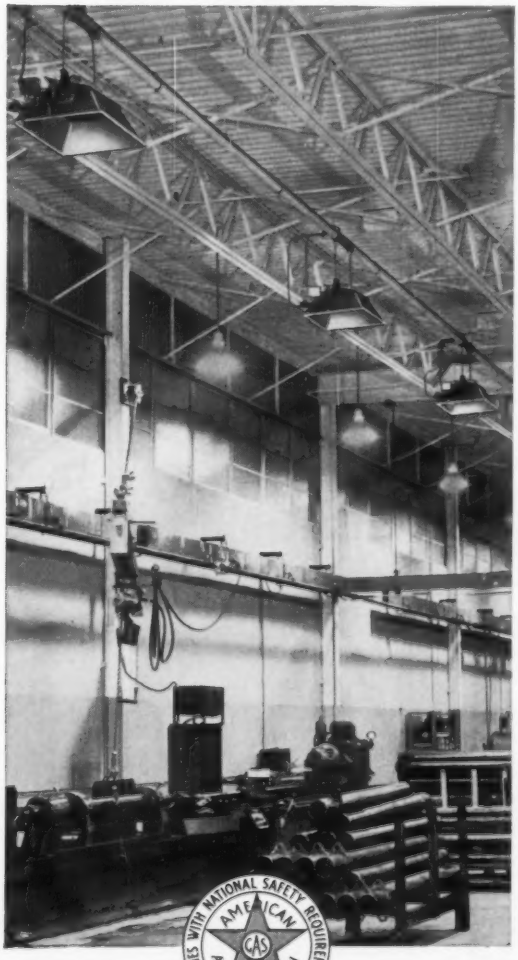

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Compute square footage of exterior walls. Deduct from this figure total square footage of doors and windows arriving at net wall area. Compute square footage of roof. Compute square footage of floor. Compute cube of building to use as multiplier for Infiltration and Air change figures . . . Use the proper "U" factors and temperature maximum with above to determine total BTU heat loss. Consult engineering handbook for "U" factors.

EXAMPLE: A building 100′ x 200′ x 15′ at eaves and 25′ at center peak. 12″ conc. block, conc. floor, metal roof 2″ insul., one air change and 0 to 65° F. temp. range.

Walls 200 x 15 x 2 plus 100 x 20 x 2 = 10,000 sq. ft.	
Windows and doors = 1507—Net wall area 8493 x .33 x 65 . .	182,174
Windows 960 x 1.1 x 65	68,640
Doors 547 x .51 x 65	18,133
Roof 52 x 200 x 2 = 20,800 x .13 x 65	175,760
Floor 100 x 200 = 20,000 x .17 x 15 (Max. Temp. less 50) . . .	51,000
***Infiltration** 100 x 200 x 20 = 400,000 x .002 x 65	52,000
Air change 400,000 x .018 x 65	468,000
Total heat loss	1,015,707 BTU

*Note: The figure 20 used in cube of bldg. is avg. ht.

Take 80% of above total or 812,565 and divide by 20,000. This will tell you the number of Van Dorn Single Generator units needed, or 41 in this case. If Double Generator units are to be used, divide by 40,000 and 20 will be required.

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MAX. REDUCED PRES. PSI	15	80	125	125	15	125	125	180
MIN. REDUCED PRES. PSI	1	5	5	15	2	5	2.5	5
STEAM SERVICE								
WATER SERVICE							*	
AIR SERVICE							*	
GAS SERVICE								
OIL SERVICE								
SINGLE SEATED								
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LETTER FROM THE EDITOR

September 1961

Dear Reader:

How does the estimating data in John Mark's article on page 103 compare with yours? This article includes piping labor man hours based upon his field experiences, and it also includes the results received from several readers after his article on this subject was published in the January issue. I would like to hear from you regarding this as soon as you have checked these values against yours.

Lester Ries has prepared another interesting article related to the space age for this issue (pages 108 to 110), and in this one he explains how precisely controlled air conditioning and extensive insulation is used to prevent movement of the huge concrete supports for missile tracking antennae at Cape Canaveral. The huge concrete supports for these installations must be stationary, and I am sure you will be interested in what has been done to meet these requirements.

In keeping with the expression, "experience is the best teacher," we present the information on page 111 which reflects many years of air conditioning design experience. The author, F. F. Stevenson, discusses the essential factors in calculating the cooling load for large buildings, and in this he covers cost considerations, types of loads, time lag along with many other points too.

Reader response on the subject of how to provide freeze-up protection for heating and cooling coils as a result of the Engineering Data File in the July issue has been great. The comments from six readers are presented on pages 115 to 119, and I believe you will find these worth reading. The subject surely is a lively one, and any comments you have on this will be welcome. Apparently much still needs to be learned before the problem is solved completely.

The methods used in air conditioning the new air terminal buildings at New York's Idlewild Air Port are worth noting. Lewis Smith has assembled the pertinent facts for you in this article on page 120.

We are indeed fortunate to have the article on page 124 by R. M. Mayfield and H. Bairot in which they present a critical review of the design of the hood ventilation system at Argonne National Laboratory. This system has been in operation for about two years, and some problems resulted in the operation which were not contemplated in the design. The authors explain what was done to correct these shortcomings, and I am sure that the fundamentals discussed will be of use to you.

High temperature hot water heating has proved to be the answer to meeting the expansion needs of the University of Hartford. E. M. Johnson explains how and why the system was selected on page 130.

Some excellent suggestions for proper selection and installation of pipe guides are given in the article on page 133. The authors, W. P. Gregory and W. C. White explain where and why pipe guides are needed, what they do to assure proper movement of the piping system during operation, and they have included three valuable tables with recommended spacing of pipe for your use.

Air conditioning a foundry sounds impractical, doesn't it? One such foundry is air conditioned, and it has been found to be very practical. The article on page 137 tells and shows how it was done.

To keep informed of the activities of the National District Heating Association, be sure to see the annual report by John Collins on page 145 which is his review of their annual meeting held recently.

Some interesting moisture migration data is reported by R. J. Zablodil on page 148. This information will aid in reducing the loads on dehumidifying equipment if applied properly.

A direct-reading chart for determining pressure losses through duct fittings is the Data Sheet (page 151) this month, and I suggest you tear it out for future use. This chart has been developed by John D. Constance and is based on standard air conditions. For calculating the friction factor and density for non-standard air conditions, be sure and save the article on page 140 by Vincent J. Turecamo.

When, how, and why electric space heating should be considered is discussed in this month's Engineering Data File. Don Bahnfleth, HPAC Engineering Editor, has prepared this feature after a great deal of thought, travel, interviewing, and calculating. It has not been easy to prepare, but this should make it valuable, and I hope you will find it to be so. Let us know what you think of electric heating after you read this.

The You'll want to Know pages (39 to 42) are included for your quick reading, and the Question of the Month (pages 94 to 98) and "Open for Discussion" (pages 87 to 90) both contain reader comments and interesting points worth noting.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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FEATURES	U.L. 1½ HOUR TESTS	U.L. FACTORY INSPECTIONS	APPROVAL BY N.Y.C. BOARD OF STANDARDS AND APPEALS
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Competitor Y	NO	NO	NO
Competitor Z	NO	NO	NO
IMPERIAL MODEL VWNYT-1	YES	YES	YES

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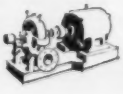
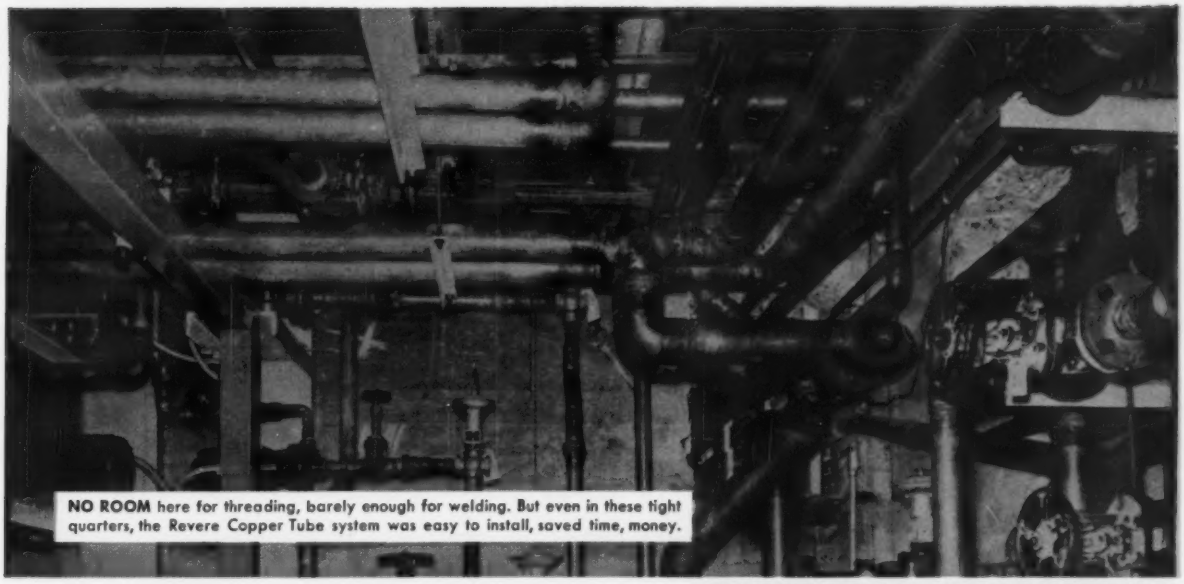
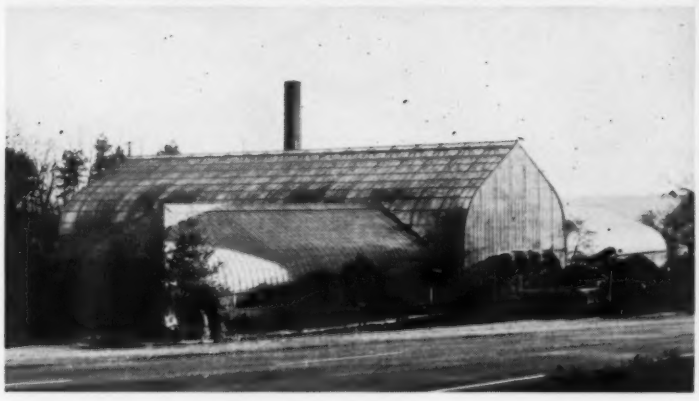


'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.



NO ROOM here for threading, barely enough for welding. But even in these tight quarters, the Revere Copper Tube system was easy to install, saved time, money.



THE JUNGLE THAT GROWS IN OHIO ...WITH COPPER AT ITS HEART

Constant dampness, year-round high heat and unusual service conditions rusted out the original heating system in a relatively short period. At the Irwin M. Krohn Memorial Conservatory in Cincinnati, this exhibit attracts more than 350,000 visitors each year to view its lush, tropical vegetation.

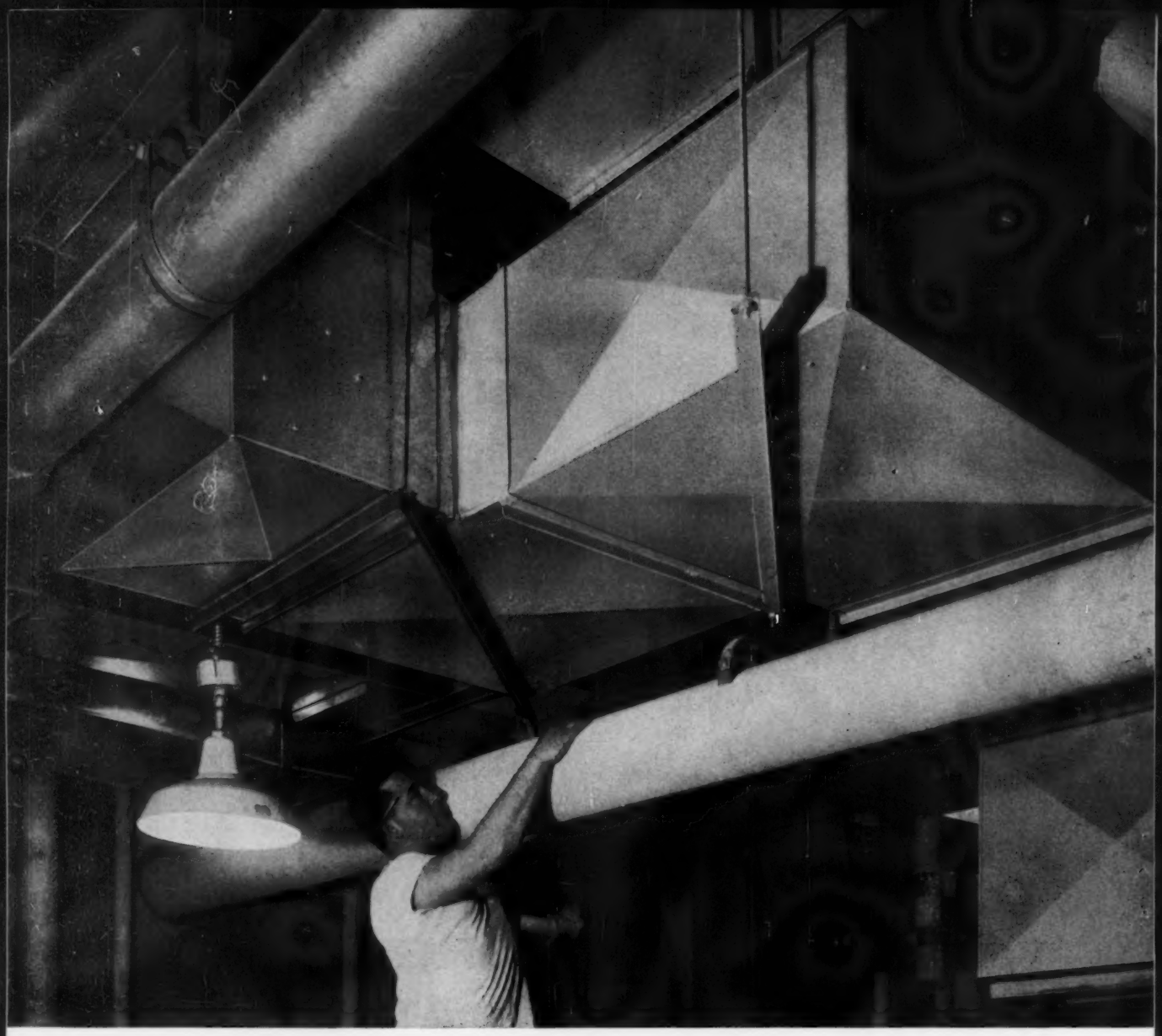
Replacement of the system was a "must", but it had to be done very quickly because of the delicate nature of many of the prize specimen plantings in the greenhouse.

The general contractor, Braun & Walters, Inc. of Cincinnati, turned to copper. Why? Copper installs quickly and easily even in tight quarters. Copper resists internal and external corrosion better than other metals. A system of copper saves time, work, money.

This installation uses Revere Type K Copper Water Tube throughout, ranging in size from ¾" through 5" . . . another of the many examples of savings made by using Revere Copper Tube. Revere is ready to help you with your next installation . . . to show you how copper can do the job better.

Building: IRWIN M. KROHN MEMORIAL CONSERVATORY
Owner: CITY OF CINCINNATI, BOARD OF PARK COMMISSIONERS
General Contractor: BRAUN & WALTERS, INC., Cincinnati
Mechanical Engineer: O. W. MOTZ, Cincinnati
Revere Distributor: MURDOCK MANUFACTURING & SUPPLY CO.

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: 230 Park Ave., New York 17, N. Y.
Mills: Rome, N.Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities.
Distributors Everywhere



Bethcon Galvanized Sheets form up easily for ductwork that's strong and rigid

Bethcon galvanized steel sheets get a special annealing treatment that gives them a desirable blend of ductility and stiffness. That's why you can form them up easily into ductwork that is rigid and strong.

Bethlehem's continuous galvanizing process applies zinc to steel so tightly that it will not peel or flake off even when the sheet is doubled back on itself.

You can get Bethcon in a wide variety of gages, in coils or in cut lengths. A Bethlehem representative is located near you, and he will be glad to give you all the details you need.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Export Corporation

for Strength
. . . Economy
. . . Versatility

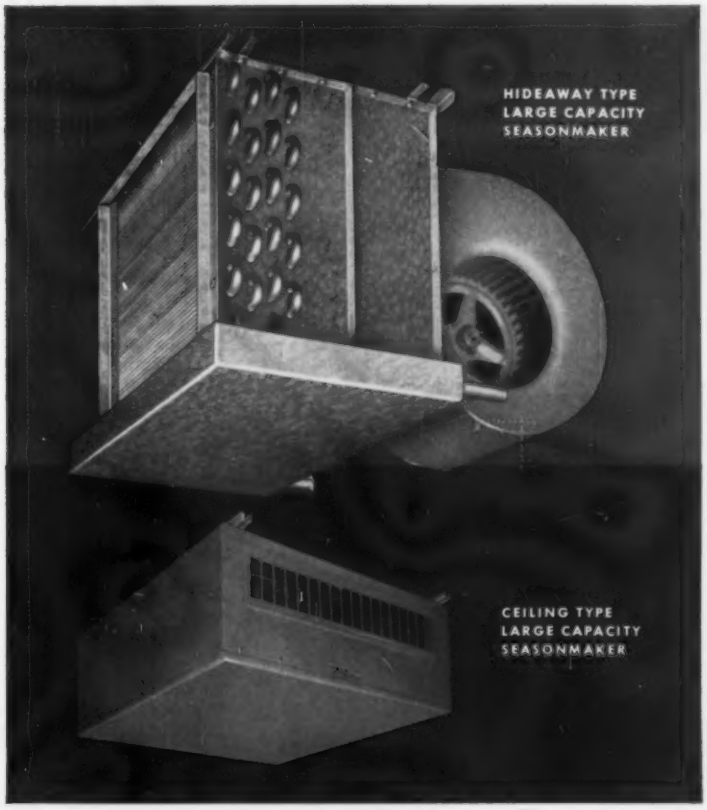
BETHLEHEM STEEL

BETHLEHEM STEEL

2 to 10 Tons Capacity

USE THESE NEW COMPACT LARGE CAPACITY

McQuay



seasonmakers

TO AIR CONDITION ALL MEDIUM SIZED AREAS

When you air condition medium to large sized areas requiring from 2 to 10 tons capacity, compare new McQuay compact large capacity Seasonmakers with all others. Compare the features...compare the quality...compare the quietness ...and you will agree that McQuay leads the field.

- ★ Hideaway models in 4 sizes—800 cfm to 2000 cfm.
- ★ Ceiling models in deluxe cabinets in 4 sizes of direct drive and 5 sizes of belt driven units—800 cfm to 3000 cfm.
- ★ New low height and compact design.
- ★ Permanent split capacitor, resilient mounted motors.
- ★ Choice of five fan speeds.
- ★ Full rated capacity.
- ★ Available with 4 or 6 row cooling coils and 1 or 2 row steam or hot water heating coils.
- ★ Sloped, Styrofoam insulated drain pan.
- ★ Exceptionally quiet operation.
- ★ Rippled fin coil.
- ★ Money saving design for easy installation and minimum maintenance costs.

The McQuay representative in or near your city will gladly give you the complete Seasonmaker story. Call him, or write direct to McQuay Inc., 1601 Broadway N. E., Minneapolis 13, Minn.

Available for immediate shipment

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

Quick Break Switch

The starting winding is disconnected from the line by this Wagner designed switch . . . test proved to make more than a million breaks. (That adds up to two starts per hour for 50 years!)

Quick Connect Terminals

Brass tabs on terminal studs permit quick, easy connection of leads . . . cut wiring time to speed assembly line production. Simply press the lead receptacle on to the stud—a positive connection is assured.

NO STARTING PROBLEMS

with

WAGNER CAPACITOR-START MOTORS

Pack more power into less space . . . give long troublefree service . . . are easy to hook up

Here are general purpose single-phase motors that have high starting torque and high pull-in torque. When used in the proper application and supplied with voltage close to their rating, they'll give positive starts every time. Troublefree operation is assured . . . thanks to the positive action of the Wagner governor mechanism and long life quick-break switch.

Wagner Type RK Motors pack more power into less space. Small enough to fit in tight spots, their ruggedness is built-in . . . permits direct mounting. They are available in a range from ¼ through 5 horsepower, with sleeve or ball bearings, and with rigid bases or resilient mountings. And, sleeve bearing fhp models can be operated in any position.

Get these motors from leading distributors in your city, or from Wagner Sales Offices in 32 cities across the country. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details on Capacitor-Start Motors.

Wagner Electric Corporation

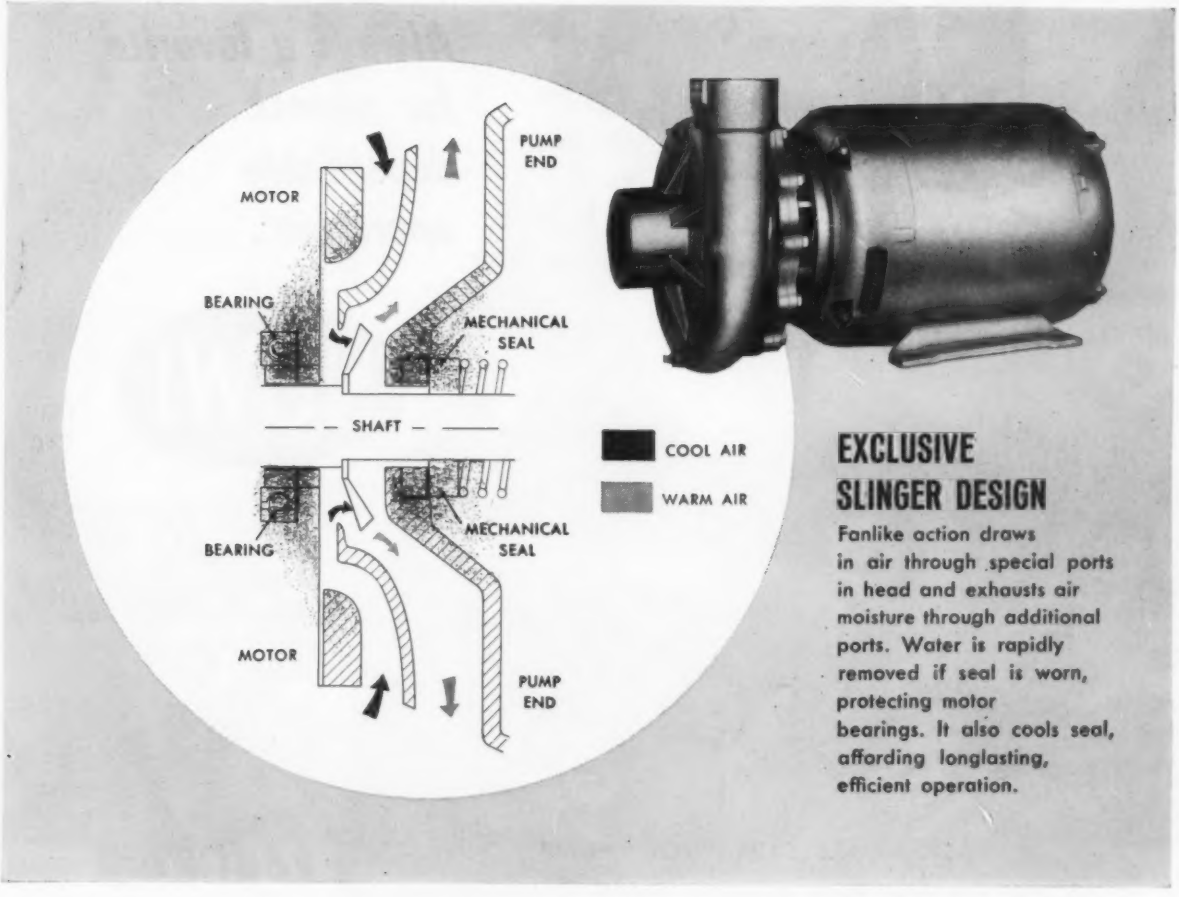
6370 Plymouth Avenue, St. Louis 33, Missouri

WM60-2A

All-Angle Operation

The sleeve bearing design, in fractional hp ratings, has a positive lubrication system that permits operation in any position . . . can mean important savings in motor costs to manufacturers.

NEW DUNHAM-BUSH A9 CENTRIFUGAL PUMPS PROVIDE 2-WAY PROTECTION AT DANGER ZONE


PUMP END
MOTOR
BEARING
MECHANICAL SEAL
SHAFT
COOL AIR
WARM AIR
MECHANICAL SEAL
BEARING
MOTOR
PUMP END
EXCLUSIVE SLINGER DESIGN
Fanlike action draws in air through special ports in head and exhausts air moisture through additional ports. Water is rapidly removed if seal is worn, protecting motor bearings. It also cools seal, affording longlasting, efficient operation.

Now Dunham-Bush offers a complete line of close coupled centrifugal A5 and A9 pumps for far reaching applications.

The new heavy duty, quality A9 pump expands the Dunham-Bush centrifugal pump line to 51 size standard models . . . 1750 or 3450 RPM, high capacity and head . . . plus non-standard pumps with special impellers.

Dunham-Bush A9 pumps contain built-in safety factors comparable to that of the pipe and fittings; components designed for heavy duty use; seals for temperatures up to 250°; case held to head with 12 bolts; discharge connection that can be rotated to 12 different positions.

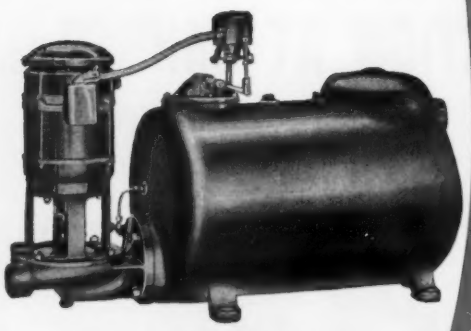
Get full details of the sensational new Dunham-Bush A9 and A5 pumps. Request bulletins 1440A and 1442.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER



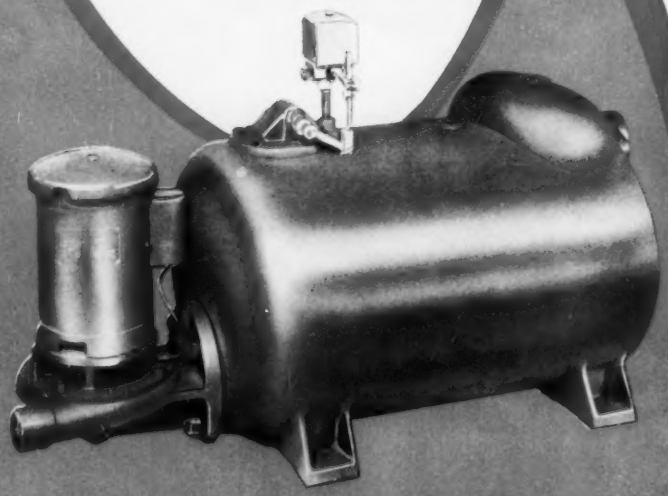
SKIDMORE
TYPE "VC" PUMP

TYPE "VC" PUMP

Always a favorite for smooth dependable operation . . .

NOW!

THE NEW SKIDMORE "VCS" PUMP



SKIDMORE TYPE "VCS" PUMP

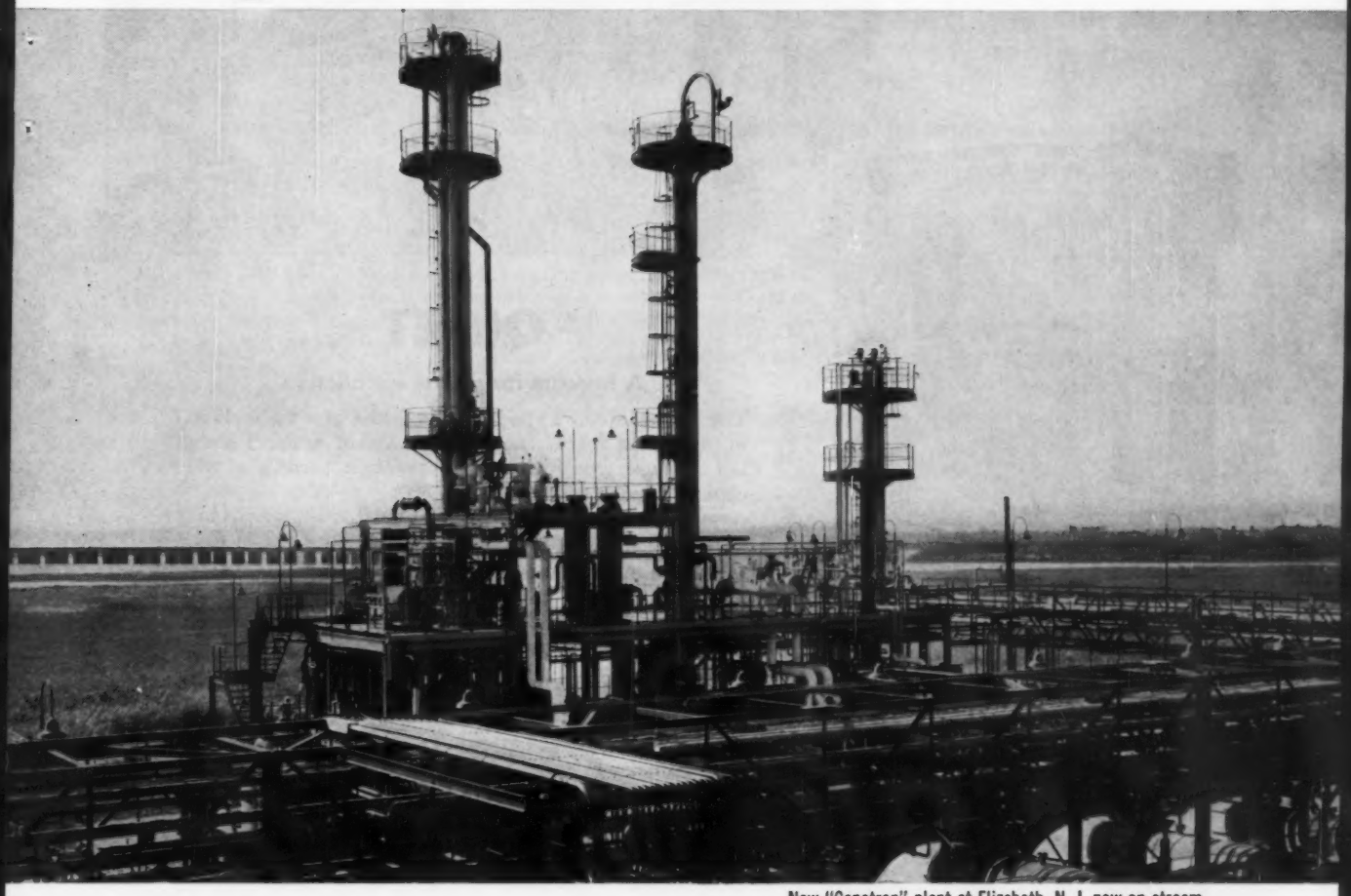
You get much more when you specify a Skidmore heating pump . . . many extra features that go into custom-made installations are standard with a Skidmore pump at no extra cost. You also get quality construction — compact design — ease of maintenance — and quiet operation. Select from a complete line of both horizontal or vertical pumps. Every Skidmore pump is engineered to meet your exacting requirements. See your nearest Skidmore Representative or write for bulletins.

Featuring mechanical shaft-seal and close-coupled design

Write today for Bulletin No. 10-C

SKIDMORE CORPORATION ST. JOSEPH, MICHIGAN

NOW 3 "GENETRON" PLANTS TO SERVE YOU!

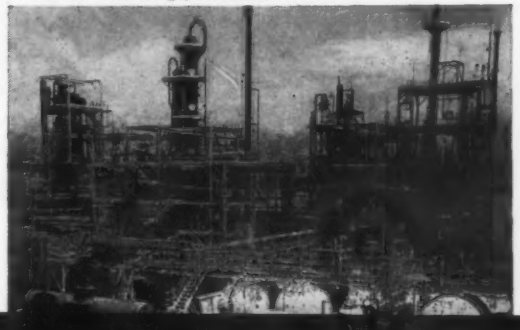


New "Genetron" plant at Elizabeth, N. J. now on stream.

Above: General Chemical's brand-new "Genetron" plant in Elizabeth, New Jersey has a capacity of more than 10,000 tons of "Genetron" per year. Its output will serve consumers throughout the Northeast. This large new plant is the third "Genetron" facility serving industry. It supplements production at Danville, Illinois, and Baton Rouge, Louisiana. These three highly efficient, big-capacity plants are three good reasons why General Chemical is your *dependable* source for highest quality fluorocarbon refrigerants and aerosol propellants. Be sure—always specify "Genetron."

Other "Genetron" production centers at Danville, Illinois

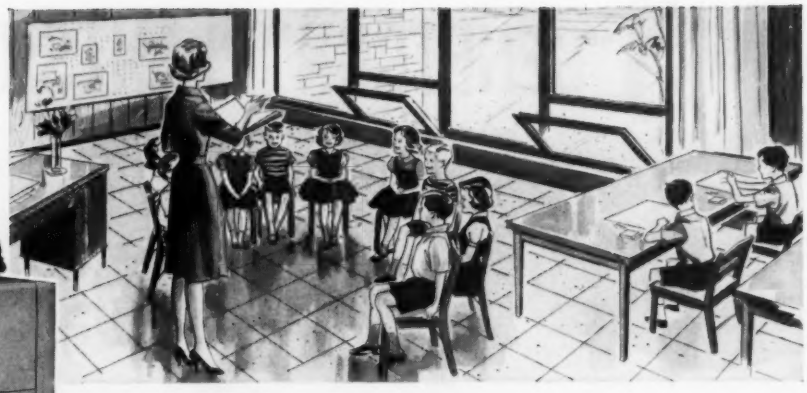
. . . and at Baton Rouge, Louisiana.



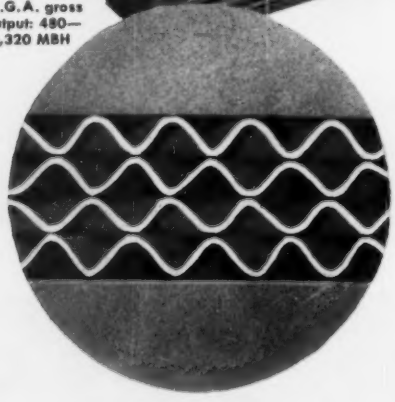
Allied Chemical

GENERAL CHEMICAL DIVISION

40 Rector Street, New York 6, N. Y.



TYPE "J" GAS BOILERS A.G.A. gross output: 480—4,320 MBH



QUIET

A favorite for school installation

The Weil-McLain Type "J" Gas Boiler is a valuable aid in conserving space...not only because of compact design but because amazingly quiet operation permits a wide choice of boiler room location.

The ribbon burners used on Type "J" boilers are designed for quieter operation, assuring noiseless ignition and flame extinction. A new flame carry-over principle provides quick and silent light-off with a minimum number of standing pilots. A gas valve with a slow opening feature is furnished as standard equipment and further contributes to quiet operation.

The "J" Boiler has no motors or fans which in other types of boilers are sources of noise and demand heavy use of electricity! It does not need a high chimney which conflicts with modern architecture...products of combustion can be expelled with only a five foot vent riser beyond the draft hood openings.

These boilers are A.G.A. approved and I=B=R rated. They are available in 33 sizes, increasing in increments of only 500 gross sq. ft. For full information write for Bulletin C-297 or see Sweet's Architectural File or Engineer's Product File.

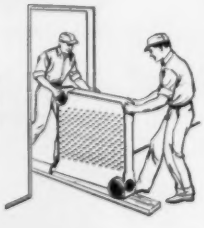
QUIET RIBBON BURNERS

Herringbone stainless steel ribbon burners are flexible over a wide range of gases, facilitating dual-fuel operation. This flexibility is also an important consideration where a switch to natural gas from other gases is expected in the future.

BOILERS FOR OTHER FUELS

Weil-McLain Boilers for commercial, industrial and institutional installations are available for gas, oil, heavy oil, combination gas-light oil, or coal. For full information, write Weil-McLain Company, Michigan City, Indiana, or see Engineer's Product File or Sweet's Architectural File.

The sections of any Weil-McLain Oil or Gas Boiler, regardless of size, can be passed through an ordinary door.



WEIL-McLAIN

CAST IRON BOILERS

"BOILERS WITH A FUTURE"

WEIL-McLAIN COMPANY, INC. • DEPT.AA-91• MICHIGAN CITY, INDIANA

VIRGINIA Chemicals

REFRIGERATION BULLETIN

Facts about water system maintenance

ANSWERS TO COMMON WATER TREATMENT PROBLEMS

Water obtained from natural sources is not really pure. It contains foreign matter in varying forms and amounts. This may be present as suspended solids or solids and gases in solution. The conventional dividing line between soft and hard water is 200 ppm (parts per million) of these impurities—the higher the ppm, the harder the water.

It is these substances that cause scale buildup. In cooling with water, evaporation takes place, causing increasingly higher concentration of the impurities. Eventually the solid matter drops out as a sludge or deposits on the metal surfaces, forming scale.

How to identify problem scales

Prepare a dilute solution of solid or liquid scale remover in a glass jar or bottle (1 tsp. of solid scale remover per ½ pt.—1 tbsp. per ½ pt. of liquid). Chip small pieces of scale from the unit, drop them in the solution and observe the action.

Magnesium or Calcium Carbonate Scale
Usually of light color. Will bubble vigorously in the solution.

Iron Scale
Usually a brown or reddish color. Bubbles slightly, but an oily ring may appear on solution surface.

Sulfate and Silica Scale
Can be any color. Usually is extra hard and flinty. Little or no bubbling in solution. Scale of high silica content may have a glossy surface.

How to remove them

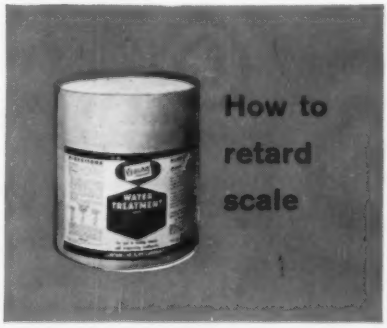
Magnesium or Calcium Carbonate Scale
Can be easily removed with either liquid or solid scale remover.

Iron Scale
Requires liquid scale remover. Use 4 gal. per 15 gal. of sump water. Stop fan to let water temperature rise to 100-110F but not over 120F. Clean at this temperature for best results. About 4 hr. needed.

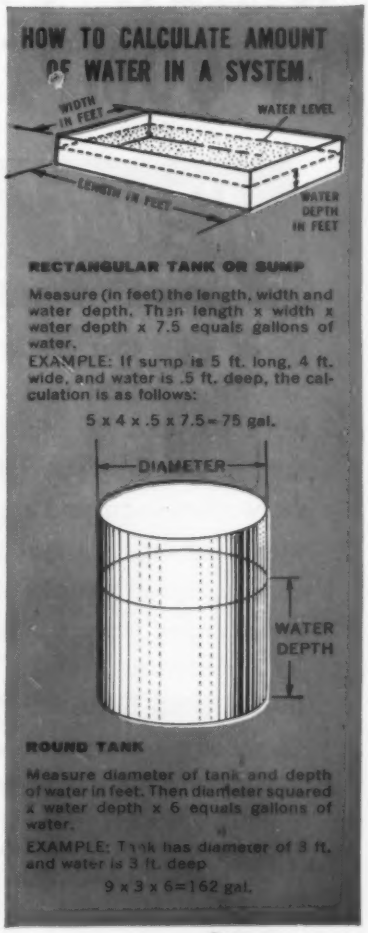
Oily Scale
First add 1 box of Dash detergent per 100 gal. of system water. Run 15-20 min. Be sure foaming is not excessive. Leave the Dash in the solution and add recommended dosage of solid (5# per 10 gal. of water) or liquid (1 gal. per 15 gal. of water) scale remover.

Sulfate Scale
Add 1 lb. of baking soda per gallon of sump water. Circulate for 8-12 hr. Then drain, rinse and refill system. Add liquid scale remover—4 gal. per 15 gal. of water. Circulate 2-4 hr., using test papers regularly to check cleaning strength.

Note: If any of these treatments fails, a second attempt should be made. A second failure would indicate the scale can be removed only by harsh chemical treatment or mechanical means.



"Virginia" Scale & Corrosion Inhibitor
Glassy polyphosphate crystals, provides slow, controlled solubility. No mechanical feeding devices are needed. Inhibitor holds scale-forming solids in suspension or solution. Deposits thin protective film on metal to stop oxidation. Has neutralizing effect on weak acids.


HOW TO CALCULATE AMOUNT OF WATER IN A SYSTEM.
WIDTH IN FEET
WATER LEVEL
LENGTH IN FEET
WATER DEPTH IN FEET
RECTANGULAR TANK OR SUMP
Measure (in feet) the length, width and water depth. Then length x width x water depth x 7.5 equals gallons of water.
EXAMPLE: If sump is 5 ft. long, 4 ft. wide, and water is .5 ft. deep, the calculation is as follows:
5 x 4 x .5 x 7.5 = 75 gal.
DIAMETER
WATER DEPTH
ROUND TANK
Measure diameter of tank and depth of water in feet. Then diameter squared x water depth x 6 equals gallons of water.
EXAMPLE: Tank has diameter of 3 ft. and water is 3 ft. deep
9 x 3 x 6 = 162 gal.

For more helpful information on water treatment problems and the chemicals needed for dealing with them, send us the coupon below.

Refrigeration Division, VIRGINIA CHEMICALS & SMELTING CO.
508 Jefferson St., West Norfolk, Va.

Send me a copy of your booklet "Water Cooling Problems—How to Correct Them"

Name_____ Title_____

Company_____

Address_____

_____

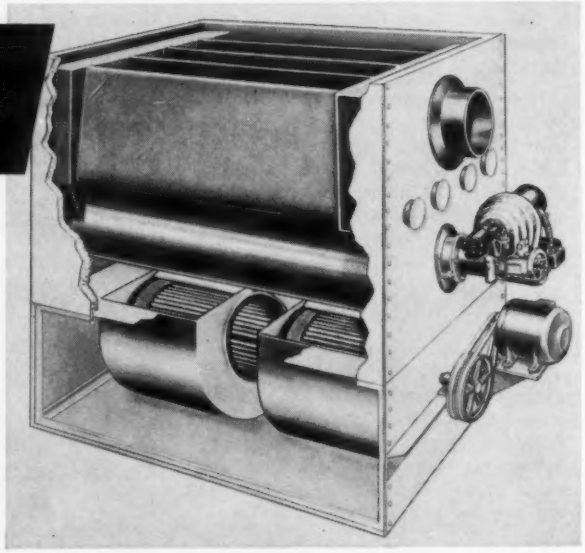
Campbell

WARM AIR HEATERS FOR LARGE BUILDINGS

A NEW STANDARD OF ECONOMY IN COMPETITIVE HEATING UNITS

NEW "F" SERIES

200,000 to 2,000,000 BTU/HR.



Here's value that challenges comparison. "F" Series Heaters are backed by Campbell's 80 years of engineering experience and manufacturing craftsmanship. Materials, workmanship and appearance compare with much higher priced units. "F" Heaters quality, specifications and performance match many heaters costing from 10% to 20% more.

OUTSTANDING EFFICIENCY

Campbell tear-drop air-flow radiators provide less resistance to air passage assuring more uniform heat transfer and exceptional fuel economy. High capacity twin blowers and above average filter capacity make possible larger air delivery with less air velocity through filters.

FLEXIBILITY—"F" Series Heaters are available in Hi Boy, Down Flow and Horizontal models to fit almost any requirement for space heating or duct systems in multi-room and multi-zone installations. Every unit easily adaptable for summer air conditioning.

EASY TO INSTALL—All "F" Heaters are complete, self-contained units; factory assembled and fire-tested. They are compact, easy to install. Units for gas, oil or gas-oil combination; all with stainless steel combustion chamber.

WRITE FOR DETAILS ON THIS "Big Value" Line!

CAMPBELL HEATING COMPANY

3123 DEAN AVE., DES MOINES 17, IOWA

Cuts costs!

Honeywell's new V4034

FLUID POWER GAS VALVE

One powerhead handles any of the six body sizes from 1 to 3 inches. Buy only the few basic bodies and powerheads *you* need for complete flexibility with minimum inventory cost. Unique fluid power principle also assures less wear, long life. Available in ON-OFF and modulating versions. Has FM and FIA approval as a shut-off valve.

Satisfy every flame safeguard need with a quality Honeywell control or system

RA890
Protectorelay*

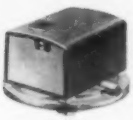
R478
Programming Relay

C7012
Ultra-Vision*
Flame Detector

L404
Pressuretrol*

M931
Modutrol* Motor

V4021
Oil Valve


C645
Pressure Switch

V4004
Diaphragm
Gas Valve

*Trademark

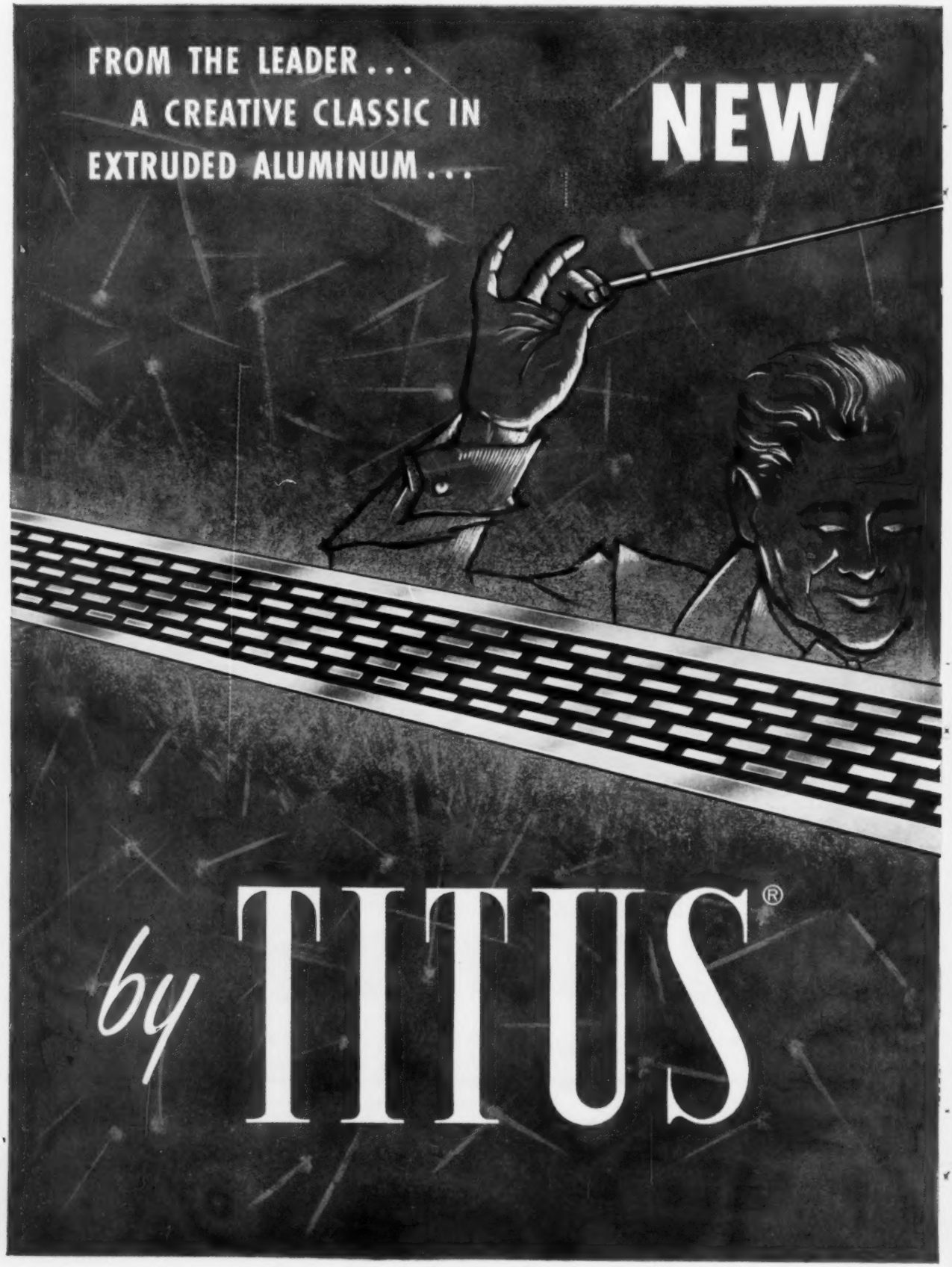
For details, write Minneapolis-Honeywell, Dept. AC-9-45, Minneapolis 8, Minn.

Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.


FROM THE LEADER . . .
A CREATIVE CLASSIC IN
EXTRUDED ALUMINUM . . .
NEW
by TITUS®

Staccato LINE

LINEAR AIR DIFFUSERS

Sharp clear notes of vibrant extruded aluminum—highlighted against a recessed background of anodized black. Available in *endless patterns* to harmonize with, or accent, any architectural motif. That's superb new Titus Staccato Line . . . with *design so decidedly different IT GIVES A STARTLING NEW DIMENSION TO THE LINEAR CONCEPT!*

And here's air diffusion efficiency to match the breathtaking beauty! Staccato Line is *perfect for in-line use on sidewall or ceiling* . . . for heating, cooling or ventilating.

Available in a wide variety of extruded aluminum border styles. Furnished in many standard widths, in any length.

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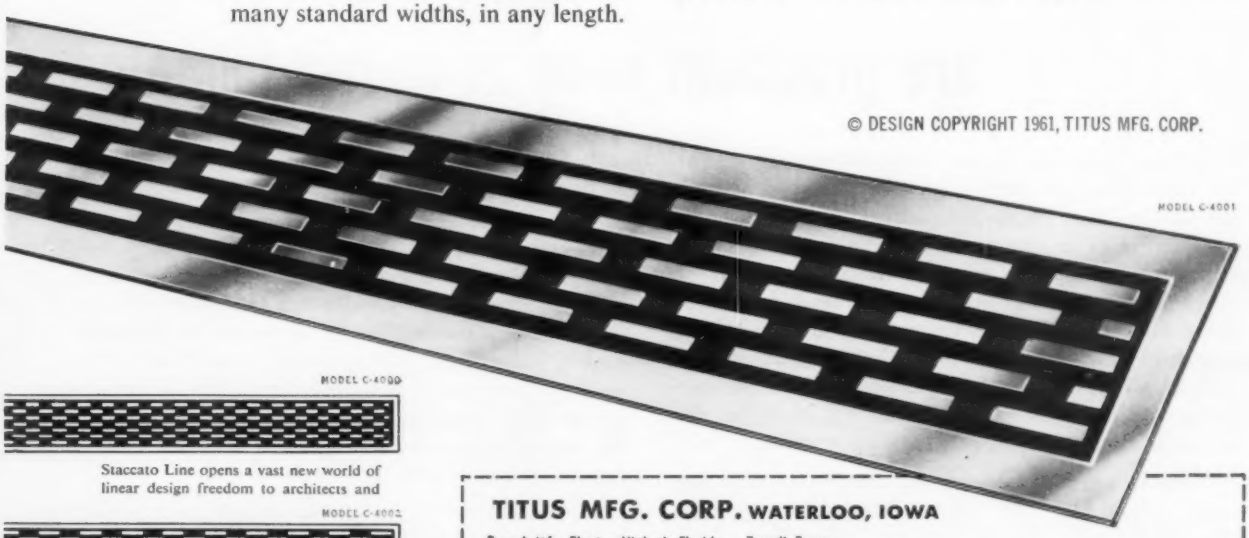
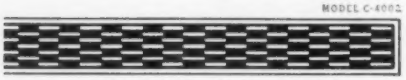


MODEL C-4001

MODEL C-4000

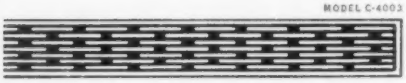
Staccato Line opens a vast new world of linear design freedom to architects and

MODEL C-4002



engineers. Select from an unlimited number of core patterns and border styles to

MODEL C-4003



develop your own individuality of design . . . or match any motif.

TITUS MFG. CORP. WATERLOO, IOWA

Branch Mfg. Plants—Hialeah, Florida Terrell, Texas

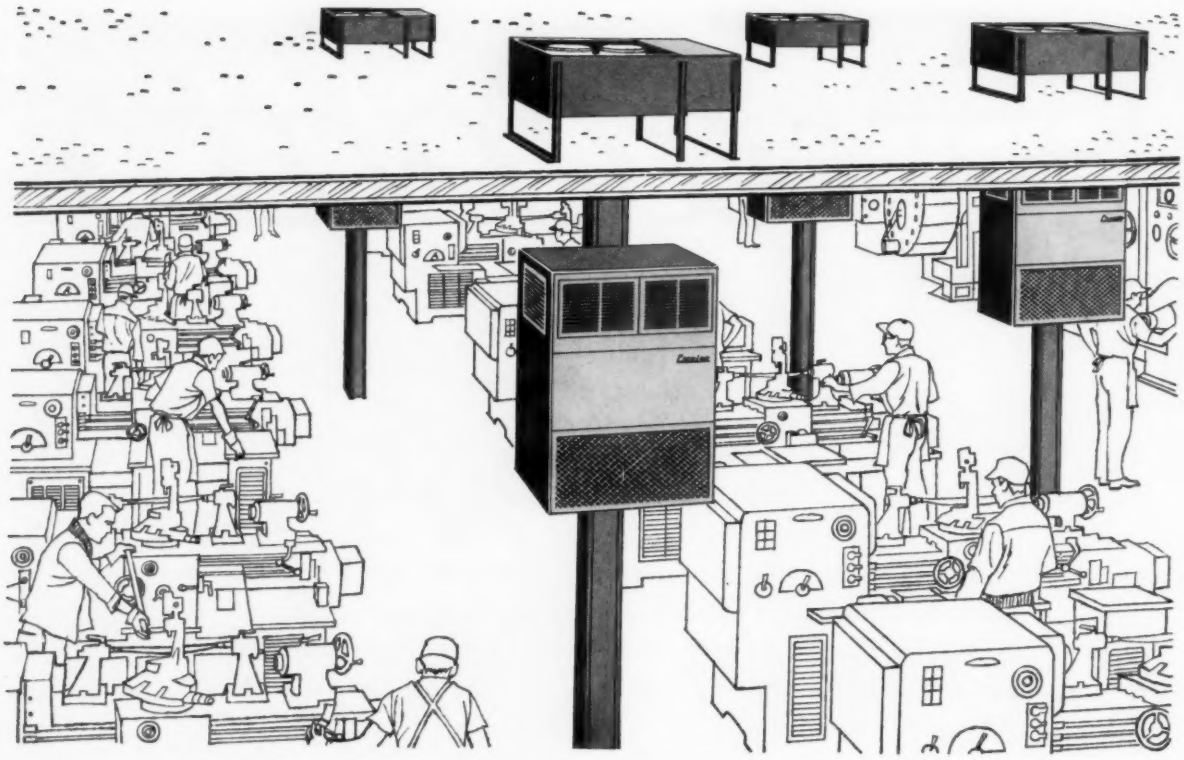
● Rush new free TITUS STACCATO LINE Linear Diffuser Catalog.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____



Typical installation: Outdoor sections on the roof; indoor sections hung on columns.

New Carrier Heat Pump Weathermakers are practical even in colder climates

If you are planning or specifying the heating system for a new plant, or replacing a plant's heating system, the Carrier Heat Pump Weathermaker* is well worth considering as an investment that can save your client money. It is no longer true that climate is a deterrent to choosing a heat pump. The improved designs of these all-electric Weathermakers combined with the heat load from concentrations of light, machinery and people in industrial applications now make it possible to operate heat pumps as economically in colder climates as many types of conventional systems.

Besides operating economies, these heat pumps are space savers, too. The indoor sections of these versatile Carrier units may be suspended from the ceiling, hung on the walls, or they may stand on the floor. The arrangement shown above is for a one-story plant of about 30,000 square feet. The indoor sections are hung on columns to allow the freedom of four-way air discharge; the outdoor sections are installed on the roof. Other arrangements can be tailored to your own particular requirements.

There are other dividends as well. Because it is all electric, soot, smoke, flame, fuel lines and storage tanks are eliminated from the heating system. Because it is also air-cooled, it requires no plumbing, water, or water towers. Because it is a one-system heating-and-cooling package, maintenance costs are cut. Fewer moving parts mean less servicing. And because a Carrier Heat Pump Weathermaker operates year-round, the normal expense resulting from seasonal startups and shutdowns is eliminated entirely.

Carrier manufactures a complete series of packaged heat pumps in addition to other air conditioning equipment. You can depend on your Carrier representative to make an impartial recommendation best suited for the job. Call him . . . he's listed in the Yellow Pages. Or write Carrier Air Conditioning Company, Syracuse 1, N. Y.

Reg. U.S. Pat. Off.

Carrier Air Conditioning Company

McDONNELL
Flow Switches

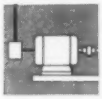
FS4 Series Flow Switch Mounted in a 2 inch Tee

Do you know how many jobs these switches can do?

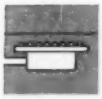
Look at the FS4 Series Flow Switch illustrated here. What you see is a compact, well-built switch that either makes or breaks a circuit (as required) when liquid flows or stops flowing. Yet in this versatile device you have both the most economical way and the most positive way of starting or stopping a signal, an alarm, a motor, a metering device—anything electrically operated. Just to highlight a few uses:—

to actuate a signal light—signal an attendant to make the right moves in operating valves, pumps and the like—signal him when flow stops in a water cooled compressor, water cooled bearing and so on.

to sound an alarm—when flow stops in a process system or in any water cooled devices.



to start or stop motors—start pumps in sequence in multiple stage flow systems; start standby pumps; stop automatically controlled units if cooling water system fails; stop compressors in cooling systems when flow stops. These are *control* functions, and almost endless.



to start or stop automatic burners—start a booster heater when water draw occurs; stop burner if flow is improperly retarded; make sure of circulation in a boiler before burner is permitted to start.

to actuate metering device—open valve in chemical feeder line; start mixing in secondary line whenever flow starts in primary line.

Think it over! Some of these uses may suggest some related problem the FS4 can solve for you right now. Notice the facts about its construction and service range opposite.

McDonnell quality throughout:

Compact switch with positive snap action. Removable cover and two knockouts for easy wiring. Phosphor bronze sylphon seals assembly leak-tight from line. Paddle made in segments to fit any pipe from 1" through 3". FS4 series, illustrated, is for maximum working pressure 100 psi; maximum temperature, 300° F., in types as follows:

FS4-3 Single pole, double throw switch. Opens and closes two separate circuits with flow. Closes and opens same two circuits with no flow.

FS4 Closes with flow, opens with no flow.

FS4R Opens with flow, closes with no flow.

Underwriters' Listed

● Model E-2 available for larger pipe sizes and pressures to 150 psi.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Coupon brings bulletin

It covers design, construction, electrical ratings and dimensions. Points out many typical applications.

Please send me a copy of Flow Switch Bulletin FS1.

COMPANY _____

ADDRESS _____

CITY, ZONE, STATE _____

BY _____

Mail to: McDonnell & Miller, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Illinois

POWELL MAKES IT A SIMPLE MATTER

To find the right valve, just call Powell. It's that simple, since Powell offers the world's largest variety of industrial valves for virtually any flow control problem . . . such as handling water, oil, gas, air, steam and corrosive fluids.

What's more, you don't have to wonder about Powell performance. It's built-in through sound engineering, development, materials and workmanship.

So, remember, finding the right valve can be a simple matter when you specify Powell Valves. For further information, call your nearby Powell Valve Distributor (there's one in every major city), or write us direct.

115th year of manufacturing industrial valves for the free world

POWELL DEPENDABLE **VALVES**

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

Ray Edwards Answers Some Questions On:

WHY IT WILL PAY YOU TO SPECIFY EDWARDS HEATING EQUIPMENT

Q. All right, Ray, answer that question: "why will it pay me to specify Edwards hydronic equipment?"

A. Edwards makes your job easier and saves you valuable time.

Q. How?

A. Edwards offers a true package. Everything having to do with the hydronic heating system can be specified from one source — that means: boiler, motorized valves, circulator, baseboard radiation. Why spend your time searching and figuring when you can get everything from one manufacturer? All Edwards heating units come completely wired so that no further on-the-job wiring is required.

Q. That's all very well, but the most important factor to me is the company behind the product—

A. Good, Edwards has been for many years a basic manufacturer of heat transfer components and equipment for residential, commercial and industrial use. We have gained a reputation for leadership in developing new systems and equipment —

Q. For instance?

A. Let's take Zone Control which Edwards pioneered. Zone heating, properly engineered, will save the end — user up to 30% in fuel costs.

Q. Just what is Zone Control?

A. In an apartment or other commercial building job, for instance, each tenant selects his own heat. To the building owner, this means very economical fuel consumption. Fuel savings of 25% to 30% are possible.

Q. Why does Edwards Zone heating cut fuel costs for the apartment owner?

A. The occupants on the upper floors do not get so hot that they have to open windows. A multistory apartment house is like a giant chimney—the upper floors receive most of the heat *unless the apartments are individually controlled.*

Q. Any other reasons why it pays to specify Edwards equipment?

A. Labor-saving installation. The Edwards heating unit comes complete with plug-in electrical connector, built-in automatic air elimination devices and correctly sized expansion tank. The plug-in connector permits the installing contractor to test the system before the building is completed and to start heat within the building.

Q. How long does it take to install your system?

A. Even the largest boilers can be set up and in operation in less than a day. Long-length baseboard radiation covers go in *fast* without fussing with splice pieces and extensions. Length of covers is up to 20 feet.

Q. How much room does the heating unit take?

A. Not very much. A 10′ x 15′ equipment room is all you need for a 100 unit apartment. This gives the owner more room for more apartments.

Q. How about price?

A. The Edwards system has the lowest installed price of any system being marketed.

Q. I understand we can use your system for heating swimming pools and snow melting.

A. True. For heating a swimming pool, just ask us to add a low-cost inter-changer and Zone Control valve. The same applies for snow-melting.

Q. What about cooling?

A. Edwards Airvec is the answer. This is another example of Edwards pioneering. It consists of a noiseless gravity operated air-cooled condenser connected to noiseless gravity air cooling units inconspicuously installed in the apartment rooms near the ceiling. A packaged zoned water chiller supplies the individual cooling units. Airvec is completely packaged in a manner never before offered to this industry.

Q. I understand that Edwards has detailed help available to engineers. Please explain.

A. Probably most important, for all types of jobs, large or small, new or remodeled, we offer you our complete handbook of Zone heating and cooling plus a *brand new* "Engineers Portfolio". The latter has complete details (on 17" x 22" broadsides) on heating and cooling for homes, apartments, motels and churches. Check the coupon below and send it to me.

EDWARDS ENGINEERING CORP.

Pompton Plains, N. J.
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PACKAGED HYDRONICS THROUGH YOUR CONTRACTOR

We are interested in:

☐ Edwards complete handbook — catalog

☐ Edwards Engineers Portfolio

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COMPANY_____

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CITY_____ STATE_____

HPAC-9

JUST ONE dual-purpose valve instead of two . . . with BETTER efficiency, LESS cost and care . . . that's what DeZurik Eccentric-Action Valves are doing on many balancing services in air-conditioning systems.

● FOR PRECISE BALANCING:

The DeZurik Valve throttles precisely, has an adjustable stop-ring which can be set to the exact balanced position.

● FOR DRIP-TIGHT SHUT-OFF:

No need to use an extra valve; the same DeZurik Valve can be closed dead-tight with an easy, friction-free partial turn.

● FOR RETURN TO SERVICE:

You merely re-open the valve to the original, positive stop position. No resetting, no rebalancing; you're back in business and in accurate balance in a second!

DeZurik Valves have replaced gate and globe valve-combinations in hundreds of systems, with obvious reductions in valve costs and in maintenance. They operate without lubrication, without chatter or bind, and emphatically without leakage. These easiest-to-operate valves have also eliminated troubles and costs in many other air-conditioning services, including service on chilled water, condenser water and cooling tower shut-off.

READY TO GO!

DeZurik Balancing Valves are drilled and tapped for quick pressure-gage installation.

Made in sizes ½" thru 30"; 2-way, 3-way, 4-way; manual, on-off or positioning actuators.

ASK FOR SPECIAL AIR-CONDITIONING BULLETIN.

DeZURIK CORPORATION
SARTELL, MINNESOTA

I HAVE NO WORRIES

Behind me is a Duriron Pipe installation for corrosive waste disposal. It goes anywhere; embedded in concrete, buried in the ground, hidden behind walls and false ceilings, and forgotten.

As a SPECIFICATION WRITER, that's important to me.

For nearly 40 years Duriron high-silicon iron pipe has been the only material consistently used for "life of the building" construction when handling acid waste. Duriron is installed by standard plumbing methods. It is available everywhere with a complete line of fittings. The man who wants the best, insists upon Duriron. How about you?

Send for latest Bulletin PF/4. The Duriron Company, Inc., Dayton, Ohio.

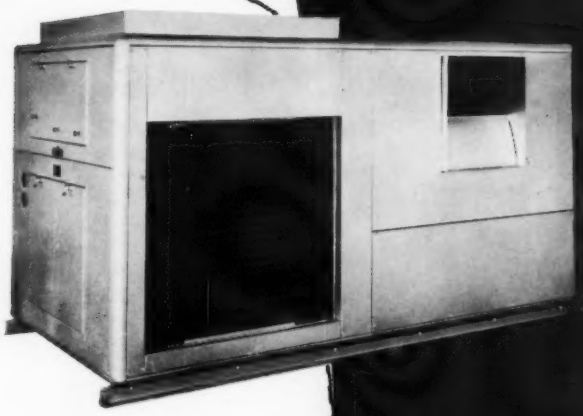
DURCO

Governair

COMPLETELY SELF - CONTAINED

AIR COOLED

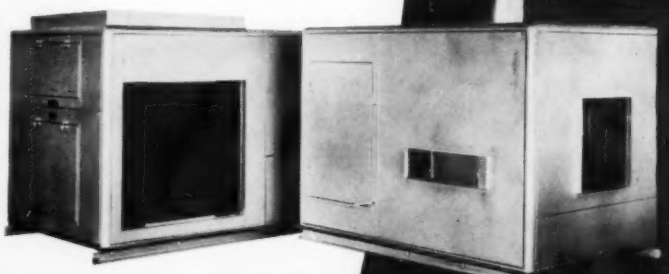
PACKAGE UNIT TYPE SCAC



GOVERNAIR'S SCAC is available in six basic models from 10 through 40 ton capacities. Typical GOVERNAIR flexibility has been maintained with a choice of 4, 5, or 6 row cooling coils offered to meet all capacity requirements. Roof mounting has been considered in the Low-Silhouette arrangement.

The basic one-piece cooling unit is housed in a rugged weatherized cabinet and mounted on rails. It is completely wired, charged and tested at the factory. Demountable and remote arrangements are available, and accessories include choice of filters, face and by-pass dampers, reduced voltage starters, Low Ambient Control, and the Gas Fired Furnace Section.

YEAR-'ROUND AIR CONDITIONING is accomplished by the use of the gas-fired furnace section. This accessory consists of a complete and unaltered gas-fired duct furnace housed in a Weatherized Cabinet with an integral by-pass damper arrangement. Refrigerated air may completely by-pass the furnace, while any desired amount of air is diverted through the furnace during the heating cycle.

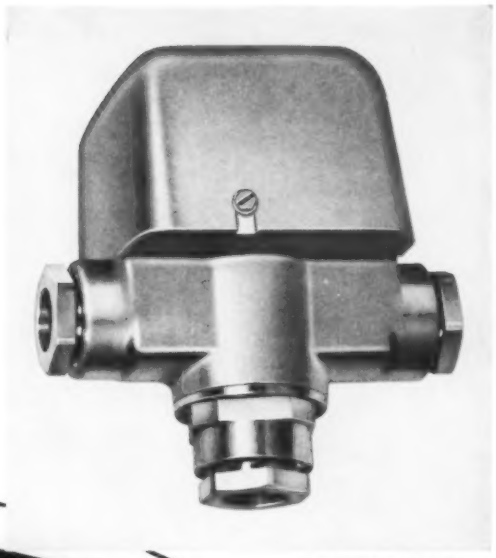


FOR AN INFORMATIVE FOLDER, CONTACT YOUR LOCAL GOVERNAIR REPRESENTATIVE OR WRITE

GOVERNAIR

Now available * *for* **FAN-COIL UNITS**

Reliable, Quiet
MOTOR OPERATED VALVES

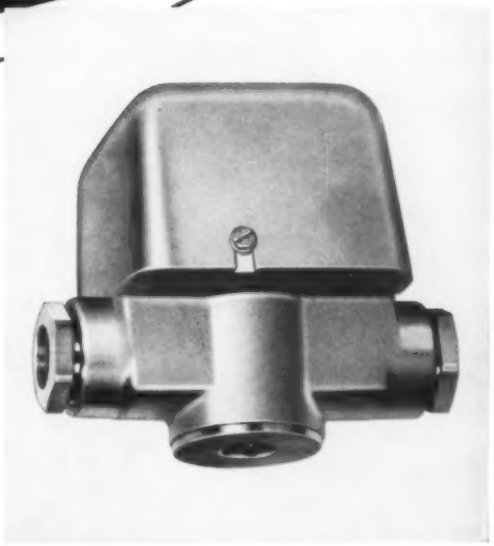


3-WAY MODEL

ERIE motortrol

SERIES 436A

2-WAY MODEL



- quiet operation
- low cost
- compact
- easiest installation
- works in any position
- high flow capacities
- simple design
- 100% shut-off
- "fail-safe" operation

* *WRITE FOR BULLETIN 210*

ERIE MANUFACTURING CO.

TRADE NAMES: MOTORTROL • ELECTROL • TIME-O-FLOW • TIME-O-GAS • PROGRAMMATIC • ELECTROMATIC

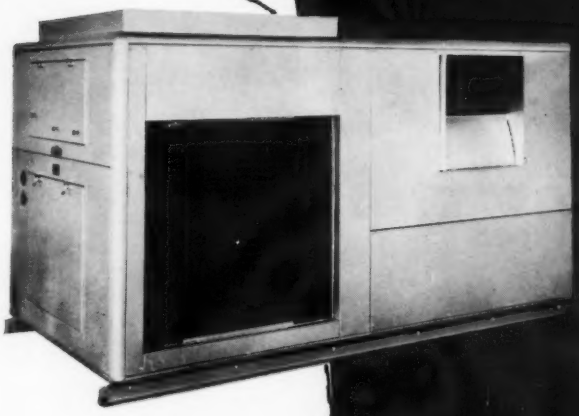
Milwaukee, Wisconsin and (Canada) Ltd., Stouffville, Ontario.

Governair

COMPLETELY SELF-CONTAINED

AIR COOLED

PACKAGE UNIT TYPE SCAC



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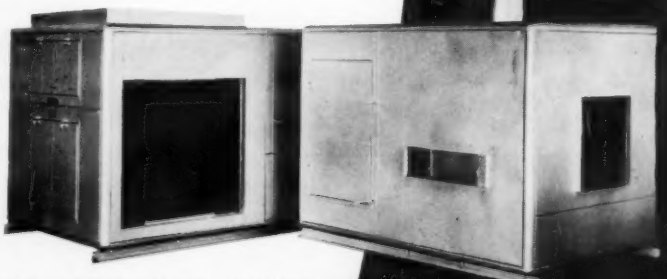
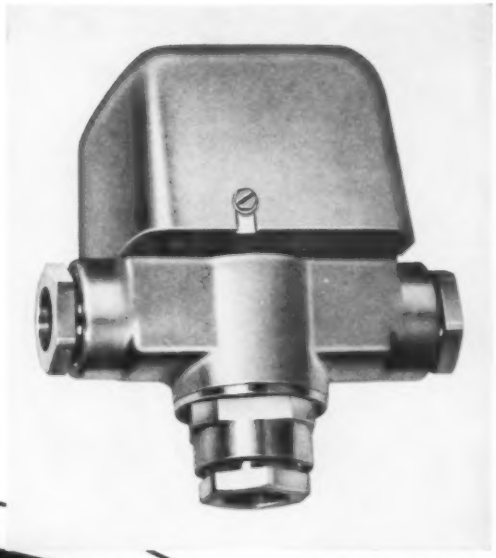


FOR AN INFORMATIVE FOLDER, CONTACT YOUR LOCAL GOVERNAIR REPRESENTATIVE OR WRITE

GOVERNAIR

Now available for* **FAN-COIL UNITS**

Reliable, Quiet
MOTOR OPERATED VALVES

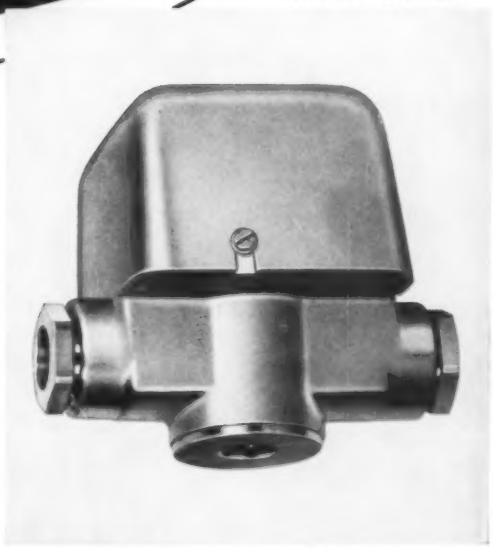


3-WAY MODEL

ERIE motortrol

SERIES 436A

2-WAY MODEL



- quiet operation
- low cost
- compact
- easiest installation
- works in any position
- high flow capacities
- simple design
- 100% shut-off
- "fail-safe" operation

* *WRITE FOR BULLETIN 210*

ERIE MANUFACTURING CO.

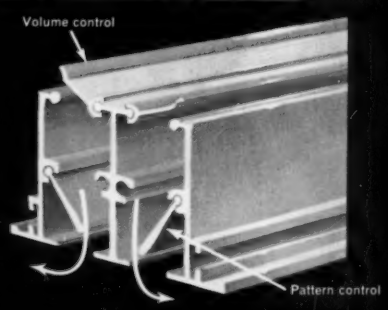
TRADE NAMES: MOTORTROL • ELECTROL • TIME-O-FLOW • TIME-O-GAS • PROGRAMMATIC • ELECTROMATIC

Milwaukee, Wisconsin and (Canada) Ltd., Stouffville, Ontario.

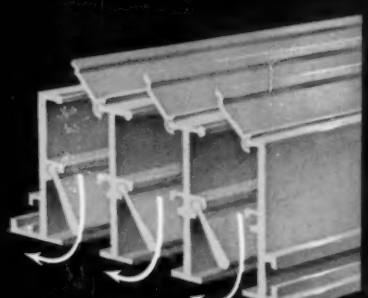
NEW FROM BARBER-COLMAN

Control-

styled for
today's interiors
. . . engineered for
environmental
control

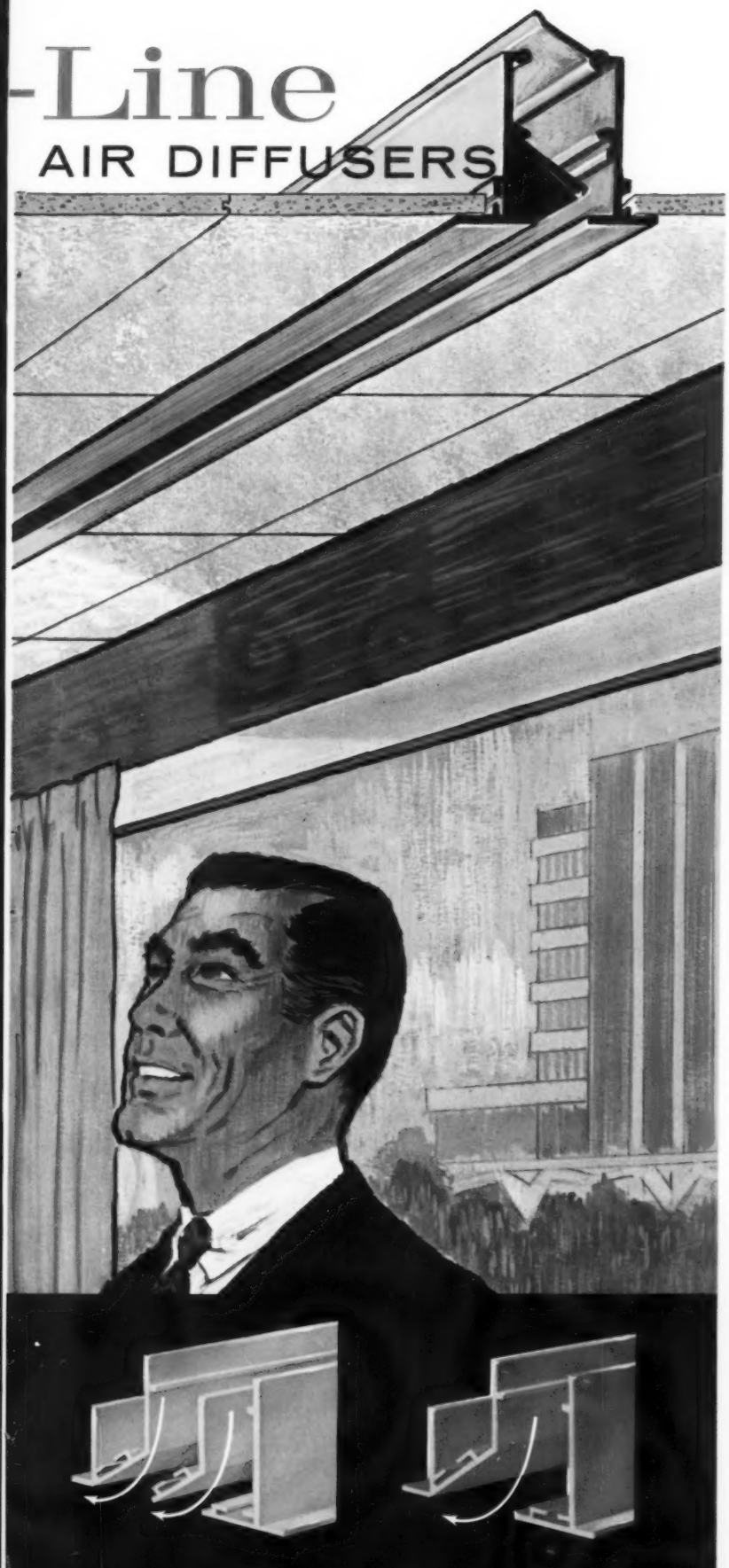


CLA two-slot Control-Line diffuser with volume control and two-way opposite pattern control



CLA three-slot Control-Line diffuser with volume control and one-way air pattern control

-Line
AIR DIFFUSERS



CLF two-slot Control-line diffuser with one-way fixed air pattern

CLF one-slot Control-Line diffuser with one-way fixed air pattern for recessed corner mounting

. . . independent control of air volume and pattern insures comfort

You get everything the name implies in a Barber-Colman *Control-Line* extruded aluminum air diffuser — linear design distinction with built-in control of both air volume and pattern.

These diffusers are light in weight, easy to handle, and simple to install in ceiling, sidewall, or soffit. They are assembled in continuous lengths by mechanical interlocking, using a key-and-slot arrangement. This assures continuity and alignment.

Available with one, two, three, or more linear openings, with built-in volume controls. Completely flexible CLA models incorporate air pattern adjustment — from horizontal to vertical throw. Can be furnished for two-way opposite or one-way air delivery as required.

The CLF models provide fixed air pattern delivery and are available in various shapes and styles to meet all architectural requirements. They may be used for any supply or return air application.

For complete information on the most advanced and complete line of linear extruded aluminum diffusers available, write for Control-Line Bulletin F-10431, *Barber-Colman Company, 1300 Rock Street, Rockford, Ill.*

BARBER-COLMAN
where originality works for you

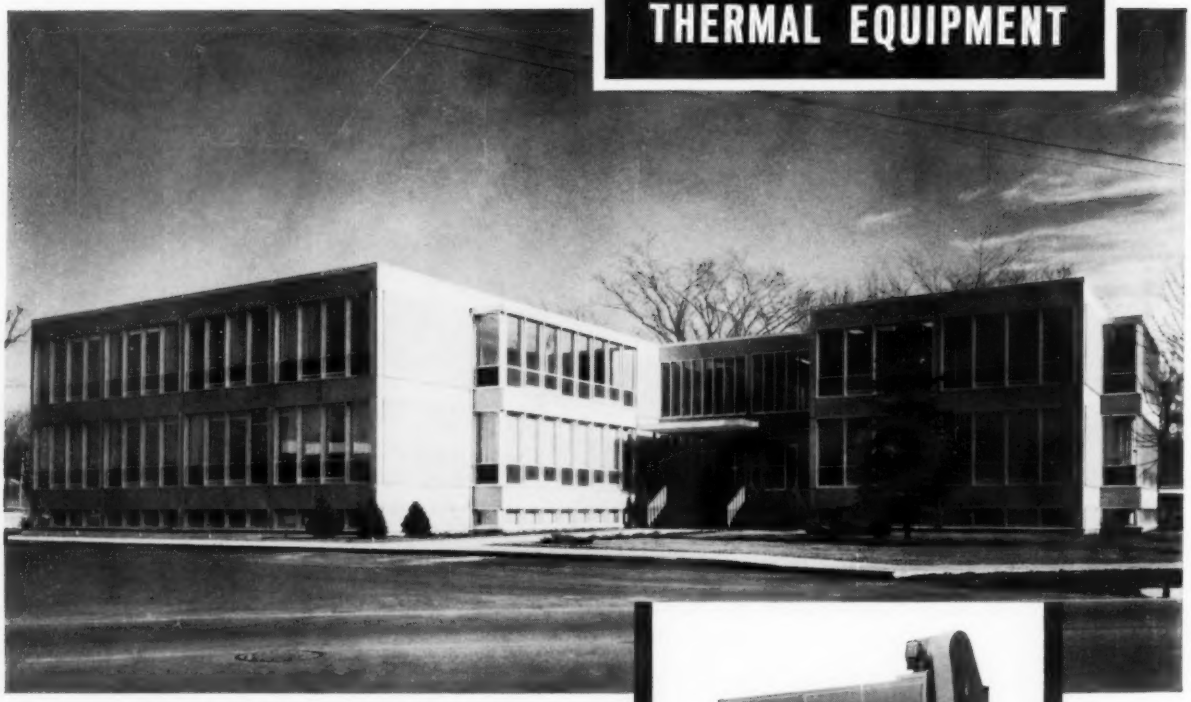
BARBER COLMAN

CLA two-slot Control-Line diffuser with volume control and two-way opposite pattern control

CLA three-slot Control-Line diffuser with volume control and one-way air pattern control

MORE

COMFORT... DEPENDABILITY... EFFICIENCY WITH ALL FORMS OF THERMAL EQUIPMENT



Consulting Engineer: Charles R. McDonald, Arlington Heights, Ill.
Thermal Agent: Barr and O'Dwyer, Chicago, Ill.

Vertical
Central Plant

Moore Business Forms, Inc., Relies on Thermal In Its Park Ridge, Illinois Offices . . .

for a dependable, long-life air conditioning and heating system, to deliver pleasant year-round comfort. From North to South and East to West—business offices and other structures are using the Thermal line of superior air conditioning and ventilating equipment to assure comfort and satisfaction. Its rugged construction warrants dependability and long life.

Thermal's wide range of sizes and models of cooling, heating and ventilating equipment permits tailoring the system to climatic and architectural requirements. The Thermal line includes central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers. For further information on air conditioning and ventilating equipment you can specify with confidence, write for complete catalog and names of nationally known concerns using Thermal.

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

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HOUSTON 19, TEXAS

AGENTS IN PRINCIPAL CITIES

CLF two-slot Control-line diffuser with one-way fixed air pattern

CLF one-slot Control-Line diffuser with one-way fixed air pattern for recessed corner mounting

you'll want to know . . .

Construction Contracts at New High; To Break Record for 15th Consecutive Year

CONSTRUCTION CONTRACTS appear to be headed for their 15th consecutive record-breaking year in 1961, according to the F. W. Dodge Corp. Paying little heed to the recent recession, total construction contracts in the first half of this year rose to $18.2 billion, a gain of 4 percent over the comparable period last year, and the second highest January through June level in history.

By midyear, all three major construction categories were running ahead of their corresponding year-earlier levels, with most of the upward push coming from the heavy engineering and nonresidential building sectors.

Among the more noteworthy trends shown by the Dodge construction figures for the first half of 1961 are these:

• Contracts for commercial buildings were at a new all-time high for the period, totalling $1,828,000,000 and up 7 percent over a year ago. Within this category, both office buildings and stores and other mercantile buildings scored impressive gains over year earlier levels.

• Educational building contracts were also running at record levels, up 5 percent to $1,545,000,000. This was on top of a 12 percent gain in the first half of last year over the 1959 figure.

• Contracts for apartment houses rose a dramatic 30 percent.

• Contracts for electric light and power systems were up 40 percent and provided most of the spark in heavy engineering contracts.

• As expected, contracts for manufacturing buildings dropped sharply, falling 12 percent to $856,000,000. However, a 19 percent rise in June may have signaled the end of the decline in this sector.

Total construction contracts in the first half of 1961 amounted to $18,220,000,000, up 4 percent from the same period of 1960. Non-residential contracts were $5,992,000,000, up 3 percent; residential contracts were $7,762,000,000, up 2 percent; and heavy engineering contracts were $4,465,000,000, up 7 percent.

Richard Wagner To Speak At C.E.C.'s Semi-Annual Meeting

PRIVATE ENTERPRISE will again be among the top subjects discussed by the Consulting Engineers Council when they assemble at Miami Beach, Fla., November 1 through 3, for their semi-annual meeting. Feature speaker at the C.E.C. convention banquet will be Richard Wagner, president of the Chamber of Commerce of the United States, and a strong advocate of the free enterprise system. His views regarding tax reform and companion measures, designed to encour-

you'll want to know

age the investment of new capital in United States industry, are well known to leaders in the fields of business and economics.

At least 200 C.E.C. delegates and guests will attend the meeting that is expected to debate again the issues concerning the consulting engineer in private practice. Among the particular topics to be discussed are: The consultant's role in private practice; corporate practice for private engineering firms; division of responsibility between architects and engineers; introduction of new standard "Mechanical-Electrical Special Conditions;" and standard accounting forms for use in private practice.

Consulting Engineers Council committee reports on such matters as professional liability insurance, "free" engineering, manufacturers' catalog indexing system, fees schedules, "moonlighting," and engineer-contractor relations, will also be discussed.

Robert P. Jaffer, a member of the C.E.C. Board of Directors, and partner in the consulting firm of Beeman, Britt, Curley and Jaffer, of Tampa, Fla., is chairman of the host Florida Association of Consulting Engineers Arrangements Committee. Earle M. Rader, of Rader and Associates, Miami, is assisting with local convention details.

The three-day meeting is open to all C.E.C. members, as well as interested non-members and guests. All registered engineers in private practice offering their services to the public are invited to attend.

The Council consists of 32 state or regional associations comprised of more than 1600 consulting engineers engaged in all fields of private practice. National C.E.C. headquarters are at 326 Reisch Building, Springfield, Ill.

HEATING PIPES in greenhouse are located overhead instead of under the growing beds, as formerly was customary. Aspen pads can be seen behind carnation grower John S. Rosa

Carnation Growing Requires Exact Temperature Control

CAREFUL CONTROL of heat and humidity is important in any greenhouse, but even more so in the Denver, Colo., vicinity where carnations form about 90 percent of the greenhouse crop. Carnation plants thrive on the sunshine of the area, but are very susceptible to cold weather and will split if exposed to it. Because of the area's altitude, a warm day often is followed by a cold night. It is not unusual for a greenhouse to require cooling during the day and heating at night.

In a typical 24,000 sq ft greenhouse, a 78 hp boiler supplies heat that is carried through more than 8000 ft of steel pipe. The piping is arranged in six zones, each equipped with motorized valves, actuated by thermostats, that maintain the temperature within a plus or minus 5 F variation. Pipes are run above the growing area to heat the entire interior, using a low pressure cooling system to control the humidity.

Cooling is achieved by pulling air through aspen pads that are kept moist by a constant drip of water. The pads are located along one side of the greenhouse, and 48 in. exhaust fans are spaced every 20 ft along the other side, according to the National Supply Div. of Armco Steel Corp.

The biggest heating problem occurs at temperatures from 25 to 40 F when the wind is blowing, as there is some heat loss around edges of the glass panes. However, when the outside temperature drops below 25 F, the high humidity inside causes icing around the panes, sealing even the most minute openings.

FIRST SNOW of winter gives the snow melting system its initiation. The installation covers 4500 sq ft of sidewalk

WORKMEN place grids for the snow melting system in front of St. Peter's Cathedral, Erie, Pa.

Snow Melting System Reduces Church Maintenance Costs, Damage to Rugs

PARISHIONERS of St. Peter's Cathedral in Erie, Pa., and the Cathedral itself are reaping the benefits of a sidewalk heating and snow melting system installed last fall throughout a 4500 sq ft area outside the church.

For the parishioners, sidewalk heating has meant greater safety, comfort and convenience in snowy weather. Cathedral officials can measure their dividends in actual dollars and cents.

According to the Right Reverend Monsignor Alfred M. Watson, Cathedral rector, the $10,000-plus installation is paying for itself in reduced maintenance costs inside and outside the church.

"Winter snow used to cost us as much as $50 a day or more in severe weather," according to Father Watson. "We had to pay about $10 an hour for snowplowing sidewalks and pay shovelers besides."

In addition to outside snow-removal expenses, Father Watson said there was the danger to carpeting inside the church from the 5000 or more Sunday churchgoers and the 400 to 500 persons who attend daily Mass.

The snow melting system employed at St. Peter's is a three-zone installation using in all approximately a mile of 1 in., 1½ in., and 2 in. steel pipe, according to Jones & Laughlin Steel Corp.

Pipe for the system was bent and torch-welded at the site. For finish welding, the pipe grid was laid out on concrete block. A 6 in. base of sand underlies the entire heated area and pieces of brick positioned in the base support the pipe grids. Reinforcing rods on each brick section keep the grid from coming in contact with the brick.

The entire system is overlaid with 6 in. of concrete poured over a 6 by 6 in. steel mesh reinforcement.

City steam heat used to heat the cathedral is also employed in the snow melting system through a heat exchanger. To prevent pipe freezing, permanent anti-freeze is added to the system at a rate of 40 percent ethylene glycol to 60 percent water.

The system was designed by Donald Kennedy, mechanical engineer, and installed by Lakes Engineering Co.

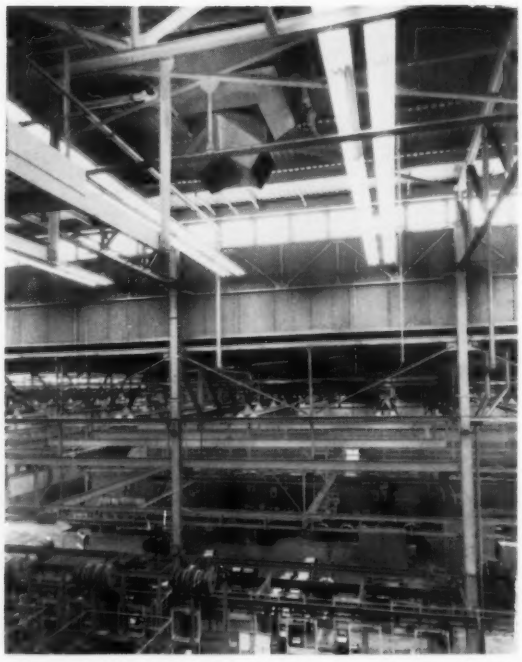
Cleaner Air Week Begins October 22

THE NATION's 13th Annual Cleaner Air Week will be observed from October 22 to 28 this year. Sponsored by the Air Pollution Control Association, Cleaner Air Week is now an established autumn fixture in the national promotional calendar.

One of the Association's principal objectives in sponsoring Cleaner Air Week is to promote the public understanding and cooperation necessary in the community-wide approach to pollution control. Local committees in scores of cities across the nation are the operating units of the campaign. A National Committee has prepared a booklet wherein procedures are suggested for organizing local CAW committees to make maximum use of the national campaign at the community level.

you'll want to know

Here's How To Heat High-Ceiling, Equipment-Filled Plants



HEATER located high in the truss area discharges to the plant area without obstruction from rows of heavy machinery and stock

HIGH-CEILING, equipment-filled plants are often difficult to heat, especially when the plants have a large number of shipping and receiving doors. How to properly distribute warm air in an area blocked by mazes of conveyors and other equipment, and how to avoid stratification are just two of the problems involved.

The General Electric Co. transformer plant at Hickory, N. C., offers a typical example of this type of problem and how it was solved. Overhead revolving-discharge heating and outside air supply units are located high in the truss area, within 20 in. of the insulated roof. Each unit has a short connecting duct to a roof penthouse having outside and recirculating dampers, automatically controlled.

In warm weather, the units bring in 100 percent outside air without heating it, according to the L. J. Wing Mfg. Co. As the weather becomes cooler, steam is admitted to the heating coils, and the dampers adjust to allow increasing proportions of plant air to recirculate through the heaters. By the time the outside temperature reaches 20 F, no outside air is being brought in at all, the dampers having reached the adjustment for 100 percent recirculation.

Since discharges rotate continuously, there is little or no problem with blocking of air circulation by equipment in the plant, nor by stacks of raw materials and products in the warehouse area. Since air flow is initiated high in the truss area, stratification due to accumulation of hot air near the ceiling is minimized at all times. And in the winter, when the problem would be most acute due to heating of inside air, the heaters are continually withdrawing part or all of the air in the truss area and recirculating it to the floor.

Heater discharges vary from approximately 28 ft above floor level in the warehouse area, to 43 ft above the floor in production areas. At floor level only gentle currents circulate and there have been no reports from employees of feeling chilled due to discharge of air at less than body temperature.

Continuous outside air supply to compensate for air removed by exhaust systems is not essential in the Hickory plant because adequate makeup air enters through the busy shipping and receiving doors. There are 30 such doors in the plant, each having a door heater mounted above it.

The only modification to the heating system since its installation has been the addition of two high level circulators. These are located above baking ovens that were installed after the original heating system was completed. The heat released by these ovens might have resulted in air stratification above them, so the circulators were installed to prevent this possibility.

Be sure to read . . .
WE HEAR THAT
beginning on page 252

CARRIER GAS-FIRED DUCT FURNACES AND UNIT HEATERS

...built for peak performance at low operating cost!

46WD DUCT FURNACES. Capacities—from 50,000 to 440,000 Btuh. AGA approved. Compact and adaptable, Carrier Duct Furnaces offer substantial savings in installation and operating costs. Their complete selection flexibility, combined with a wide range of sizes, permits economical custom-tailored installations in all types of buildings. They may be installed in multiples for larger jobs.

Whether used as main heat source or booster heaters for central air distribution systems, as independent heaters with matching blower unit, or in combination with many types of air conditioning systems, there are any number of arrangements to fit specific applications. A full line of open and encased blowers is available with each size furnace.

46W UNIT HEATERS. Capacities—from 30,000 to 300,000 Btuh. AGA approved. Carrier Unit Heaters include as standard equipment many features unobtainable in so-called economy models, or offered only as "optional accessories" on many standard models. These quality features are standard on all sizes—and result in quiet, low-cost operation. Units are finished in durable gray baked enamel for attractive appearance and long life.

Other features include automatic shut-off safety pilot switch against pilot failure . . . completely concealed electrical wiring and controls . . . streamlined motor-fan assembly for quiet air delivery . . . built-in draft diverter to insure proper burner operation . . . and a pressure regulator that controls gas input evenly to burners under varying line pressures.

Whatever the application, there's a Carrier Furnace or Unit Heater to handle the job to your satisfaction. For information, call the Carrier representative listed in the Yellow Pages under "Heaters—Unit." Or write Carrier Air Conditioning Company, Syracuse 1, New York.

Carrier offers every type of equipment for any job

Carrier ***Air Conditioning Company***

Heating and Ventilating Units for steam and hot water | **Unit Heaters for steam and hot water** | **Gas Unit Heaters and Duct Furnaces**

QUIET CENTURY MOTORS DRIVE FANS AND BLOWERS IN MODERN HOSPITAL

Quiet running Century motors help drive a heating and ventilating system that must function with precise dependability at all times. While quiet reliability is desirable in any heating system, it is absolutely necessary to the function of a modern hospital.

For example, a 1½-hp Century motor provides the silent power for the exhaust fan shown at left. This system circulates fresh air through wards, rooms and work areas. Hum, rumble, and vibration are virtually eliminated with shock mounts and Century motors' quiet sleeve bearings and dynamically balanced rotors.

In addition, several 3-hp Century motors drive blowers that efficiently circulate warm air through hospital areas at separate and specified rates. Carefully engineered ductwork plus ample blower-motor capacity provide this area-by-area control.

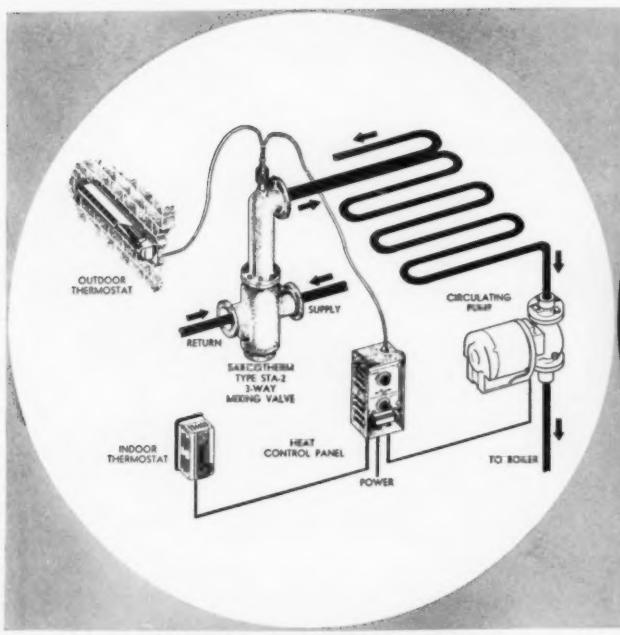
For added flexibility, a multi-speed Century motor drives the hospital's ventilating unit. Rated at ¾ to .19 hp and 1735 to 865 rpm, air circulation through this unit is readily adjustable to the building's varying needs.

For example, the required rate of air exchange in the kitchen increases radically during cooking hours when ranges are operating and producing heat and smoke. Multi-speed motors provide the extra ventilating capacity needed at these peak hours.

These applications are typical of the limitless ways in which Century's complete line of motors (1/20th to 500 hp) provide dependable power to all types of air-moving equipment. Your Century sales engineer (he's a full-time motor specialist) can help you to select just the right motor for your heating and ventilating application. 61-7

CENTURY ELECTRIC COMPANY

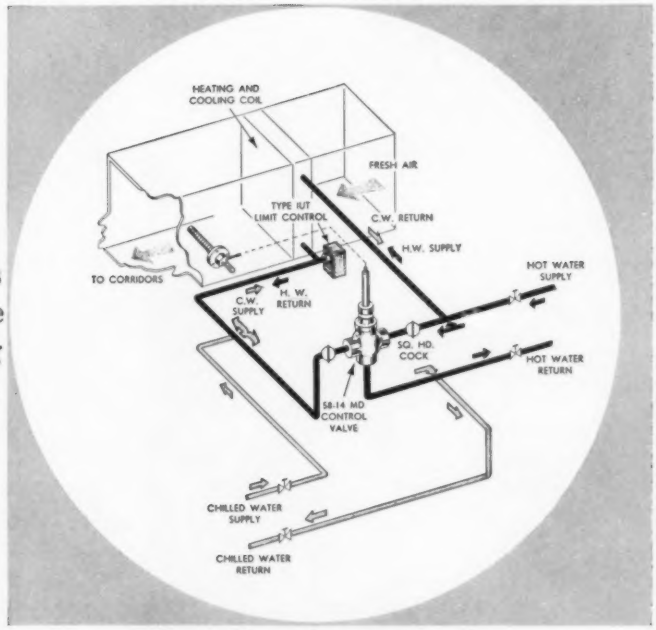
St. Louis 66, Missouri *Offices and Stock Points in Principal Cities*



THE PRACTICAL APPROACH TO TEMPERATURE CONTROL SYSTEMS BY SARCOTHERM

FOR HOT WATER AND RADIANT HEATING SYSTEMS

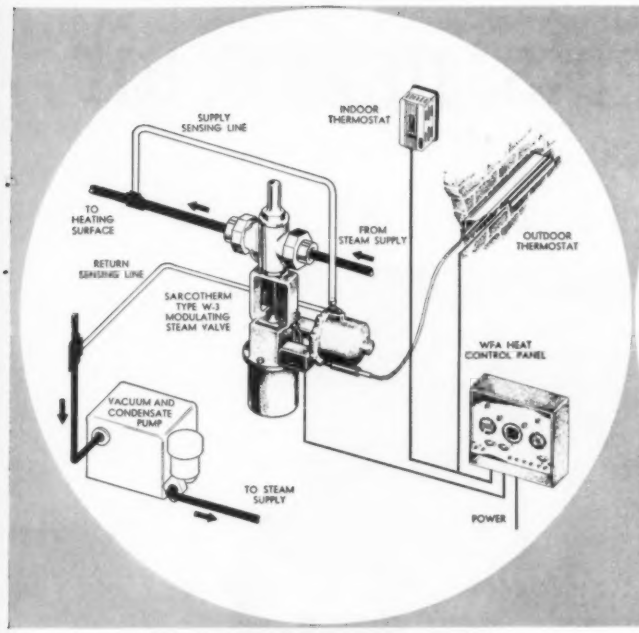
Here are a few typical examples of Sarcotherm's practical down-to-earth approach to your temperature control problems. You get all the control you need – economically, dependably, with a minimum of piping and wiring and no extraneous components. Thousands of Sarcotherm control systems—plus the full line of Sarco heating specialties – are providing excellent service in buildings throughout the country, in a wide variety of steam, hot water, and radiant heating applications. You are invited to consult with our engineers on any automatic control system problem.



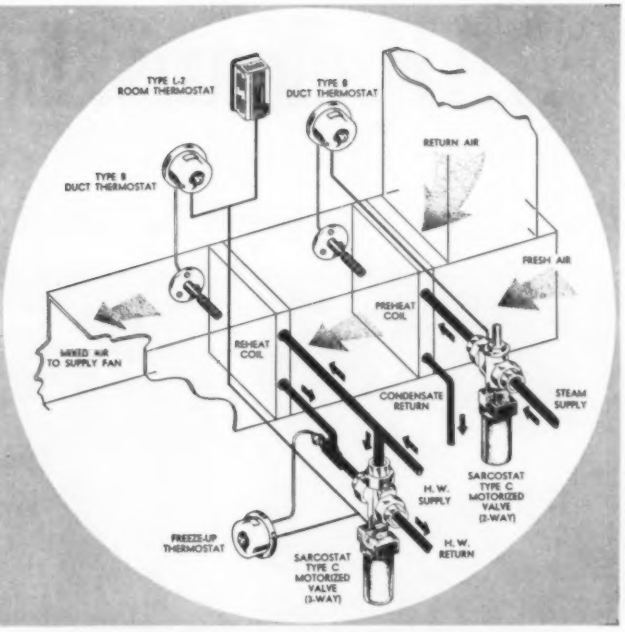
FOR HOT AND CHILLED WATER CONTROL

WRITE FOR COMPLETE CONTROL SYSTEM CATALOG

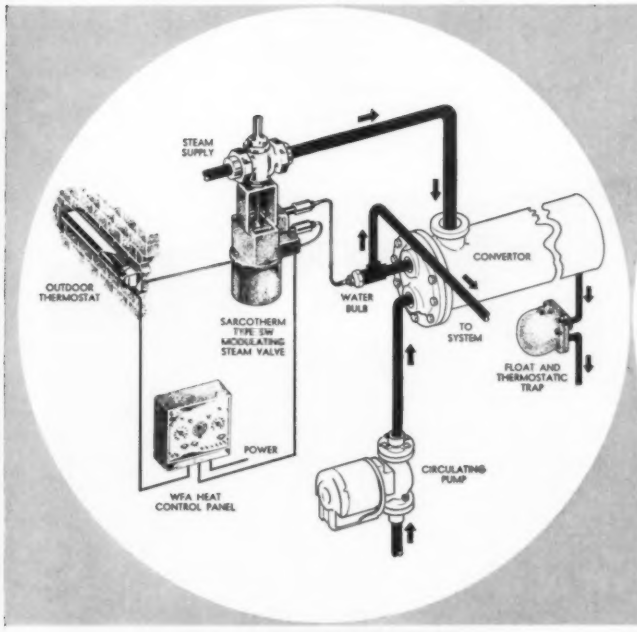
SARCOTHERM



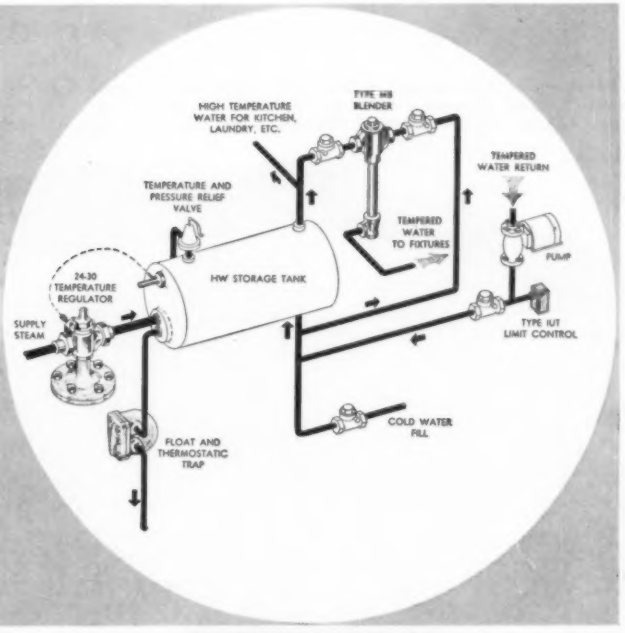
FOR STEAM HEATING SYSTEMS



FOR HEATING AND VENTILATING UNIT CONTROL



FOR CONVERTOR CONTROL

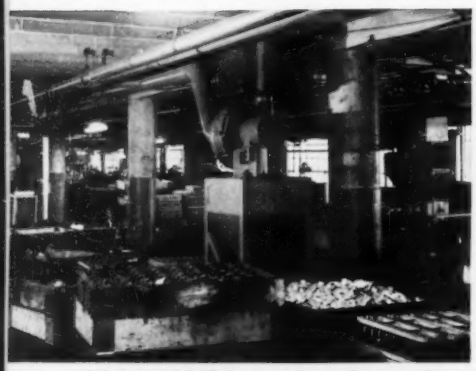


FOR DOMESTIC HOT WATER CONTROL

6094

SARCOTHERM CONTROLS, INC.
AN AFFILIATE OF SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

AAF cleans, heats, moves air



A battery of AAF dry-type dust collectors exhausting grinding operations. After-cleaners on collectors provide for re-circulation of cleaned air.

AAF packaged central station air handling units, suspended from the ceiling in the warehouse, save valuable space, provide quiet operation.

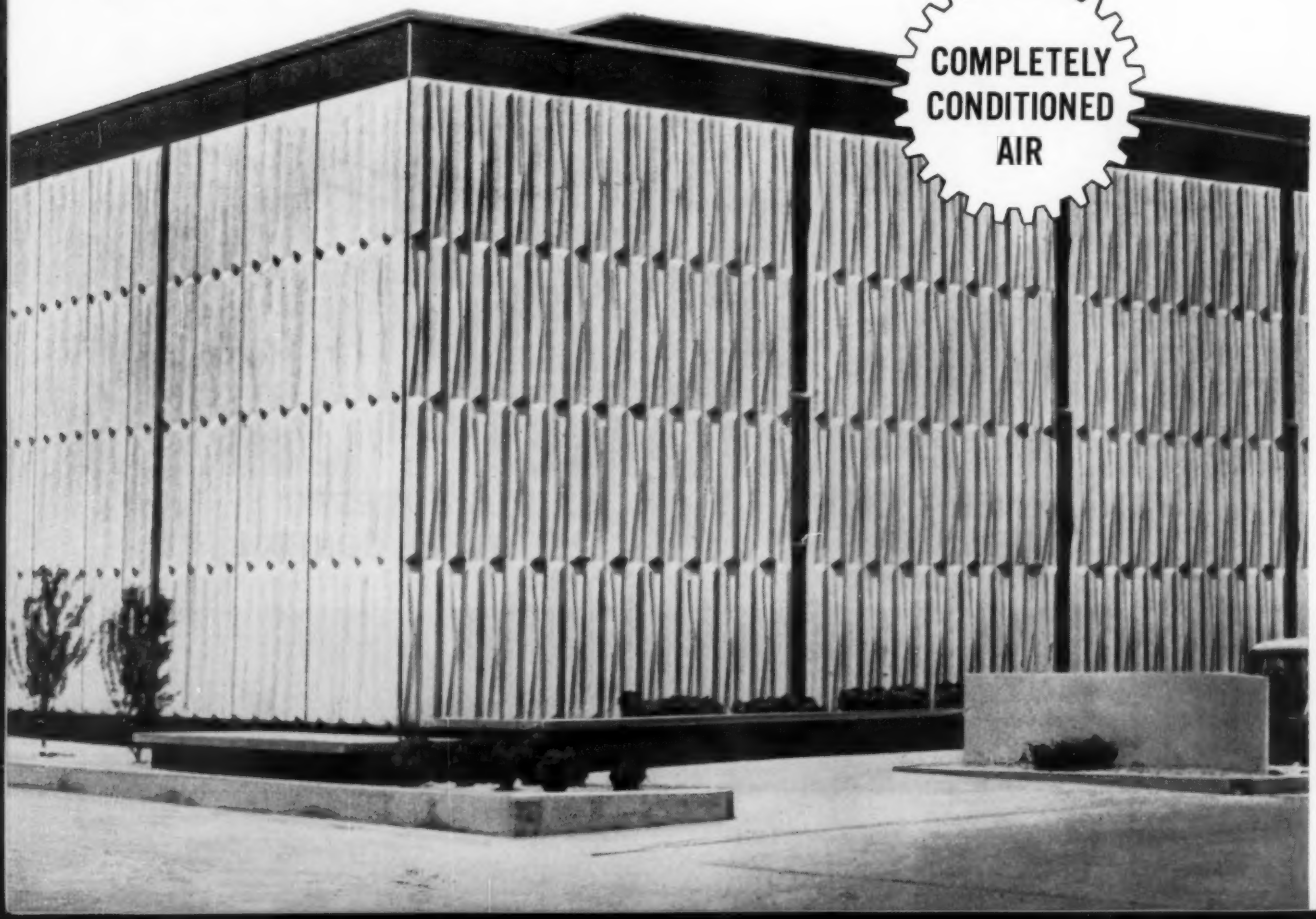
AAF

AIR CLEANING PRODUCTS
Air Filters
Dust Collectors

AIR CONDITIONING, HEATING & VENTILATING PRODUCTS

AAF electronic air cleaners provide clean air for the Maytag Headquarters Building, Newton, Iowa. Architects: Brooks-Borg, Des Moines. Air Conditioning Engineer: William Nanes, Des Moines.

COMPLETELY CONDITIONED AIR



to make it work for Maytag

Multi-product installation demonstrates AAF's capability for complete air engineering

THE manufacture of major appliances demands that air be put to work in many different ways. Here are the jobs it had to do at the Maytag office and plants in Newton, Iowa: (1) help keep the interior of the impressive new headquarters building perpetually clean, (2) control dust from grinding operations, (3) provide heating and ventilating for the warehouse and service repair area, (4) control dust from polishing operations, (5) provide proper exhaust from plant and processing operations, and (6) help provide a dust-free atmosphere in the enameling department.

AAF is the only company that provides *all* the major components for *completely* conditioned air. Just as important, AAF offers the knowledge and experience to coordinate the functioning of these components into one integrated system.

If air must do many jobs in the building you are planning, talk with AAF. Booklet 518 describes the complete line of AAF component products. If you would like a free copy, address Richard W. Smith,

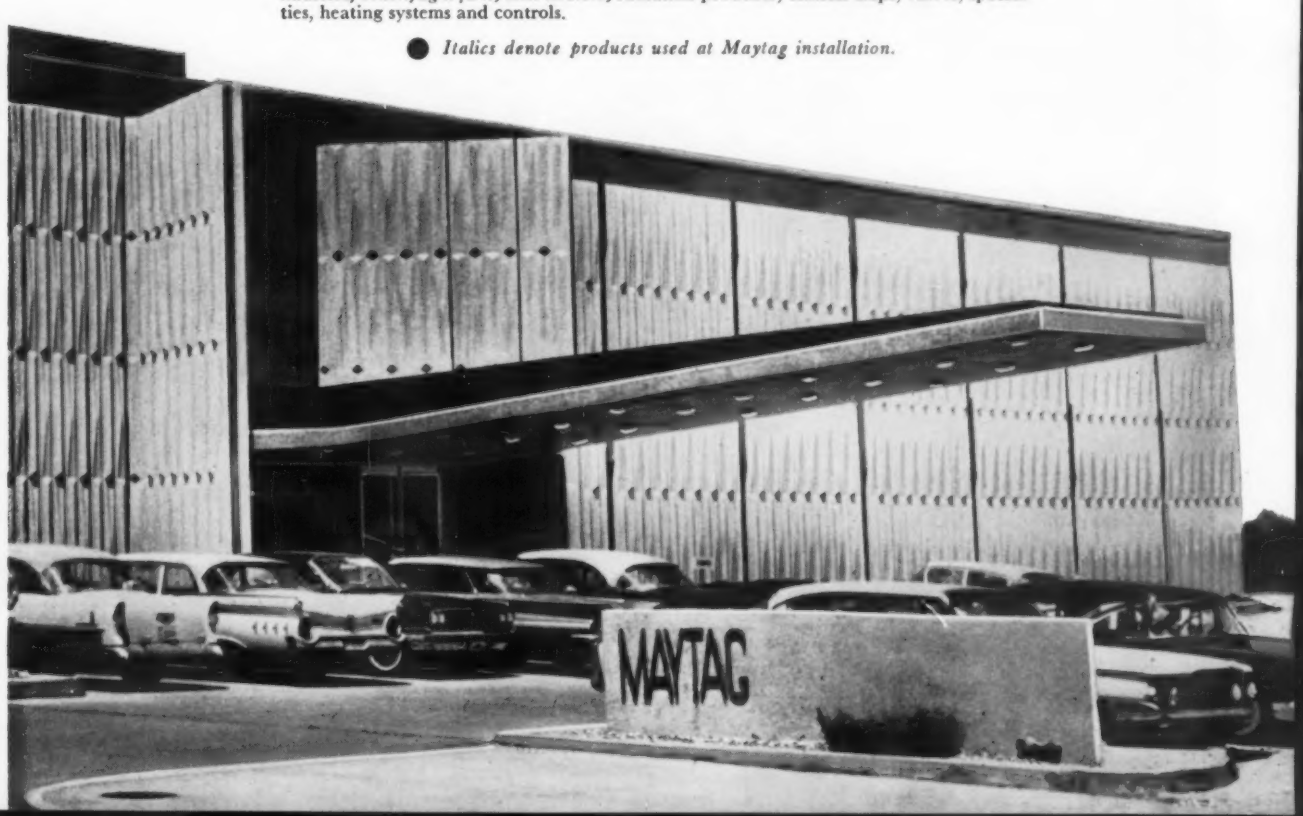
American Air Filter Company, Inc., 373 Central Ave., Louisville, Ky. In Canada: American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

AIR CLEANING: (Atmospheric Dust) *AAF electronic air cleaners, automatic air filters, unit filters,* engine & compressor filters. (Process Dust) electrostatic precipitators, *wet-type collectors, dry-type collectors,* fabric arresters. AIR CONDITIONING, HEATING & VENTILATING: Herman Nelson air conditioning unit ventilators, unit ventilators, portable heaters; Kennard/Nelson dual-duct air conditioning units, multi-zone air conditioning units, *packaged central station air handling units,* sprayed-coil dehumidifiers, fan-coil units, packaged liquid chillers, cooling towers, evaporative condensers, direct-expansion coils, water coils, steam coils, *unit blowers,* industrial exhausters, *centrifugal fans, unit heaters,* radiation products; Illinois traps, valves, specialties, heating systems and controls.

● *Italics denote products used at Maytag installation.*

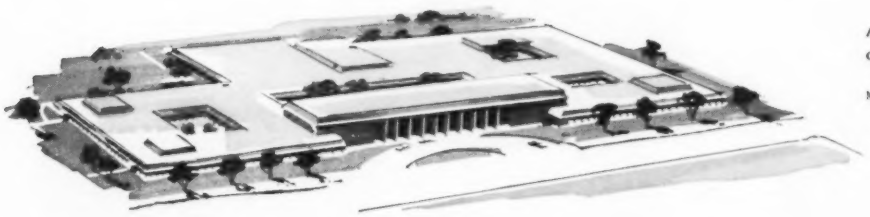


Edward Ross, President, Economy Plumbing Co., Mechanical Contractor for the Pure Oil Building, Palatine, Illinois, says:

"Pure Oil was an elaborate Honeywell helped

Mr. Edward Ross of Economy Plumbing. Mr. Ross found the Honeywell Selectographic Data-Center of great help in analyzing the performance of Pure Oil's temperature control systems.

job, but
us over the rough spots"



ARCHITECTS: *Perkins & Will, Chicago*
CONSULTING ENGINEER: *E. R. Gritschke Assoc., Chicago*
MECHANICAL CONTRACTOR: *Economy Plumbing Co., Niles, Ill.*

At Pure Oil's new home, individual temperature control in over 400 rooms is maintained and constantly supervised by a Honeywell Selectographic DataCenter*.

"This new Pure Oil Building has one of the most intricate temperature control systems we've ever seen," says Mr. Ross. "In fact, there are more individual controls than in 99% of the systems built today." Mr. Ross adds: "We counted on Honeywell for accurate scheduling and over-all supervision of the installation—and they came through! Honeywell always had enough engineers and technicians on the job to keep everything rolling smoothly. It's very reassuring to know Honeywell's on your team."

The Honeywell Selectographic DataCenter controls temperatures for the entire Pure Oil Building. It also includes control over a building-wide security system and fire alarm system. Because the fire alarm system is hooked up to the local fire department, one of Honeywell's many jobs was to indoctrinate the Palatine Fire Department on the Selectographic and the new fire alarm system.

With 76 years experience in temperature control you can depend on Honeywell quality and service. Fine controls, accurate specifications, prompt delivery and expertly supervised installations are assured with Honeywell on your team. And only Honeywell designs and manufactures all three types of control systems—pneumatic, electric and electronic. For further information, call your nearby Honeywell Office. Or write Honeywell, Dept. AC-9-126, Minneapolis 8, Minn.

*Trademark

Fred Heiden, Utility Operator for the Pure Oil Building, seated at the Selectographic DataCenter.

Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

CALL ON Phillips CUSTOM ENGINEERING

TO SOLVE YOUR COOLING TOWER PROBLEMS

noise

freezing

space

maintenance

atmospheric conditions

Wouldn't you like to have years of research and development experience put to work on your cooling tower problems? Then call on PHILLIPS... the cooling tower manufacturer with this wealth of experience... plus the technical ability to apply it to your particular case. No problem too big... none too small. And when PHILLIPS designs a CUSTOM ENGINEERED COOLING TOWER for your particular problem... rest assured it will be the most efficient and most economical solution possible.

No wonder each year more and more specifications call for PHILLIPS CUSTOM ENGINEERED COOLING TOWERS

EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

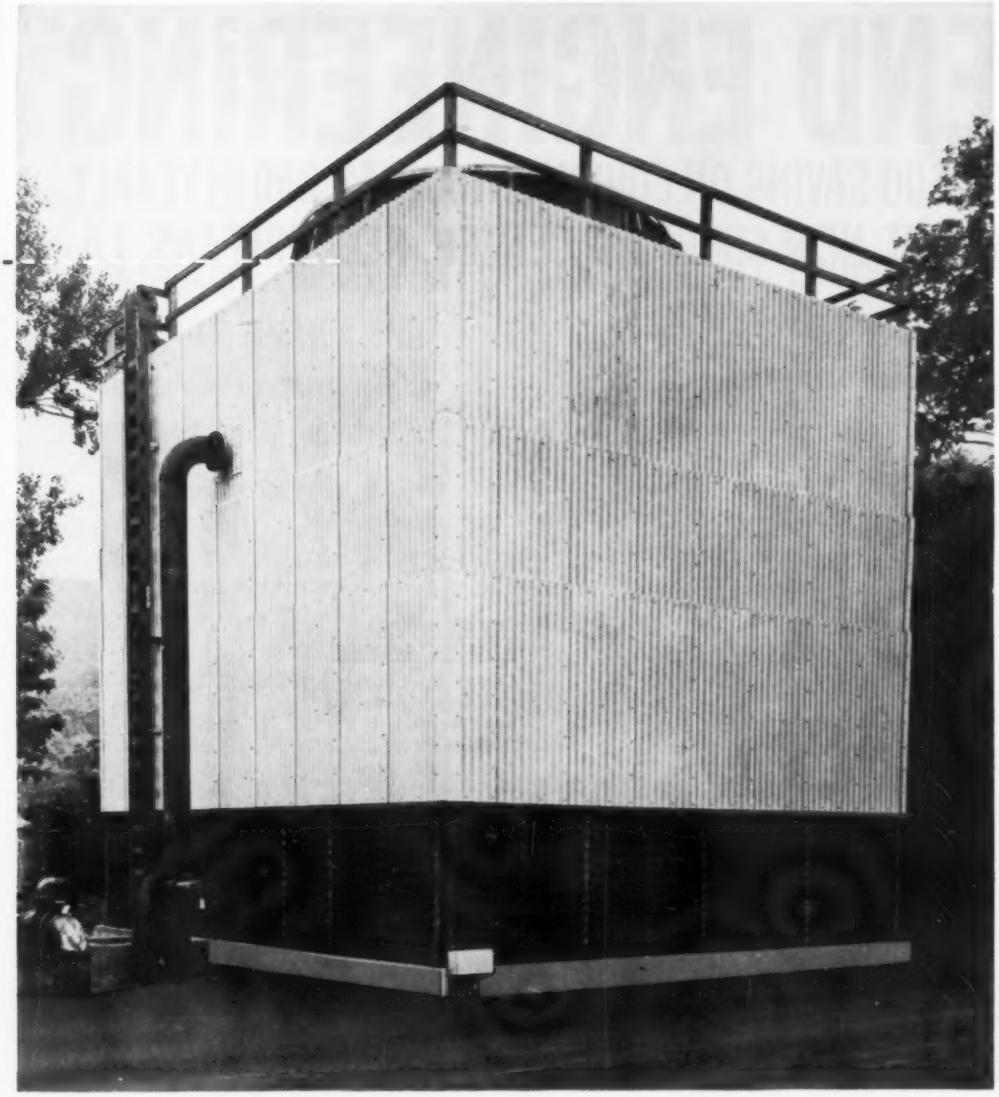
BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

DISTRIBUTION SYSTEM
Spray nozzle type or open Weir gravitational type system.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.



UNION CARBIDE CO.
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another problem solved by: Phillips CUSTOM ENGINEERED COOLING TOWERS

THE PROBLEM:
To get maximum cooling with a limited concrete basin area in order to save on construction costs.

SOLUTION:
Phillips custom-engineered cooling tower with framing dimensions specially designed to use the maximum area with a minimum of concrete.

RESULT:
A complete efficient cooling tower at economical cost.

SPECIAL FEATURES ON ALL TOWERS

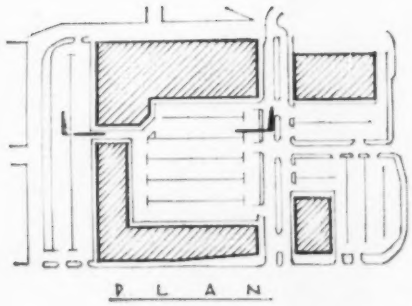
Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

WRITE FOR LITERATURE

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N.Y.

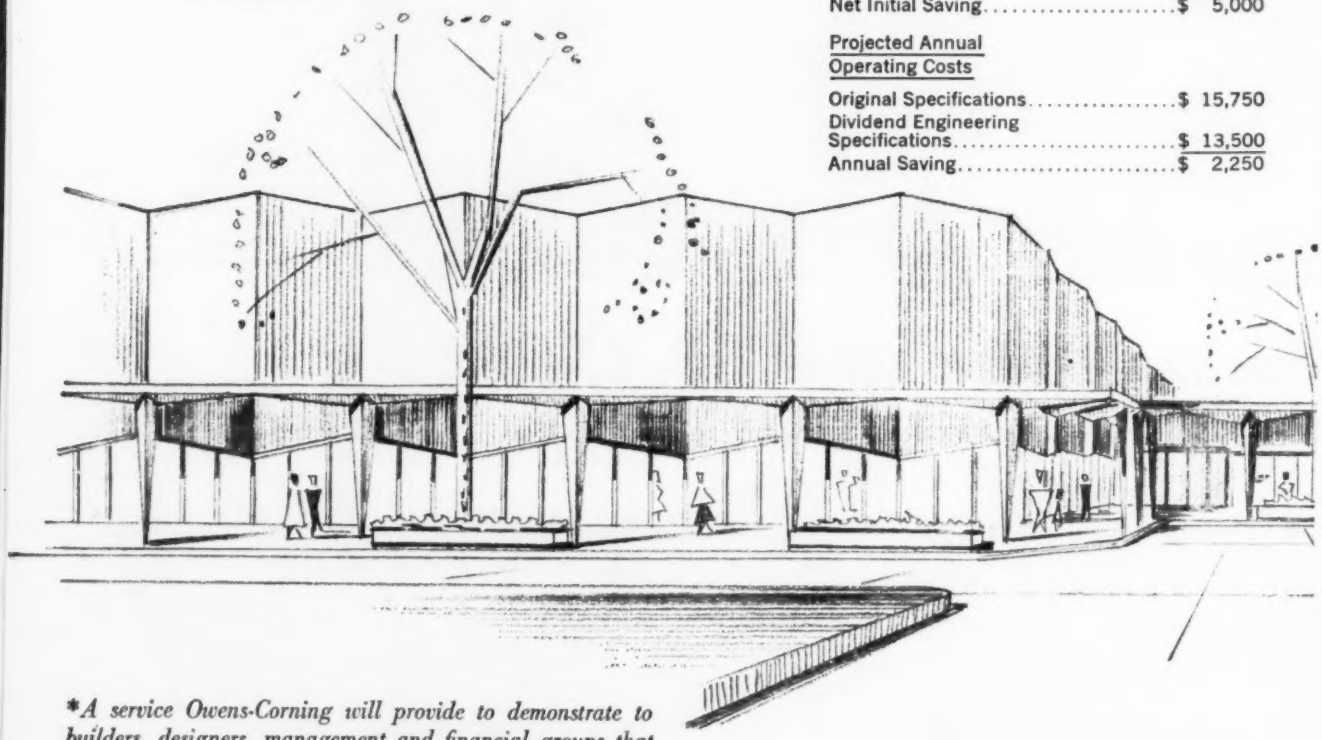
DIVIDEND ENGINEERING*

FORECASTS A $30,500 SAVING ON EQUIPMENT AND $2,250 IN YEARLY OPERATING COSTS AT NEW SHOPPING CENTER, NEW ORLEANS, LA.



DIVIDEND ENGINEERING
DOLLAR-SAVING PROPOSAL

Cost of Heating & Cooling Equipment	
Original Specifications	$277,000
Dividend Engineering Specifications	$246,500
Predicted Saving	$ 30,500
Additional Insulation Cost (in place)	$ 25,500
Net Initial Saving	$ 5,000
Projected Annual Operating Costs	
Original Specifications	$ 15,750
Dividend Engineering Specifications	$ 13,500
Annual Saving	$ 2,250



**A service Owens-Corning will provide to demonstrate to builders, designers, management and financial groups that optimum use of Fiberglas materials can result in reduced initial and operating costs and improved building performance.*

A $25,500 INVESTMENT IN ADDITIONAL INSULATION PREDICTS THESE SAVINGS:

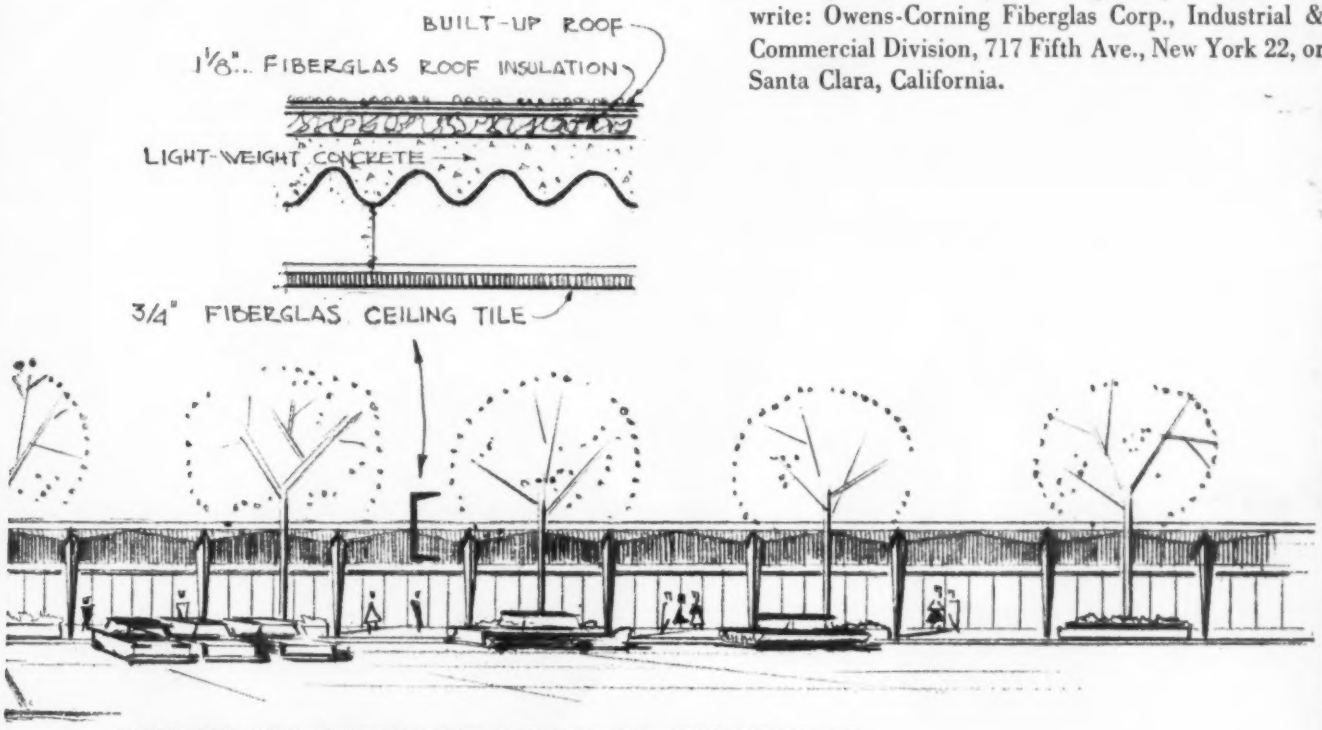
$30,500 ON HEATING-COOLING EQUIPMENT

Original specifications called for a light-weight concrete roof slab and Fiberglas Perma Ply† Built-up Roofing. A Dividend Engineering analysis forecast that installing 1⅛" of Fiberglas Roof Insulation at a cost of $25,500 would reduce the equipment cost by $30,500—a $5,000 net saving to the owner.

$2,250 FORECAST SAVINGS IN ANNUAL OPERATING COSTS

Dividend Engineering calculations also forecast a $1,361 saving in power for cooling, and another $889 in heating costs.

Let us show you how Dividend Engineering forecasts a high return on the owner's investment, and makes the benefits of year-round air conditioning economically feasible for more and more industrial and commercial buildings. Just talk to your Fiberglas representative, or write: Owens-Corning Fiberglas Corp., Industrial & Commercial Division, 717 Fifth Ave., New York 22, or Santa Clara, California.



CARROLLTON AVENUE SHOPPING CENTER, NEW ORLEANS, LA.—HEATED AND COOLED
Architect: Curtis & Davis and Associated Architects & Engineers, New Orleans and New York City.
Mechanical Engineer: H. C. Goldstein, New Orleans.
General Contractor: Gervais Favrot Co., New Orleans.
Fiberglas products used in this installation: Perma Ply Built-up Roofing; Roof Insulation; Ceiling Board; Duct Insulation.

OWENS-CORNING RESEARCH pioneers in making things better with

OWENS-CORNING
FIBERGLAS

†T-M. (Reg. U.S. Pat. Off.) O-C.F. Corp.

New G-B Duct with welded aluminum casing gives you air distribution, thermal insulation, sound absorption, and vapor barrier — all in one economical product!

New G-B Duct is made entirely of high-density fiber glass insulation enclosed in a hardened aluminum casing and sealed by a unique welding process. It is the one product that fulfills all these requirements: • *meets strictest fire codes for commercial heating and air conditioning* • *gives the superior thermal efficiency inherent in high-density fiber glass insulations* • *reduces noise as effectively as 1½" thick duct liner* • *cuts installation cost as much as 50% . . . each 6' section combines thermal insulation, sound absorber, and vapor barrier in one lightweight, ready-to-use air duct* • *provides the same air friction coefficient, diameter for diameter, as bare sheet metal, thus eliminating conversion calculations.* Before you write your next specification, it will pay you to thoroughly investigate G-B Duct. Write for detailed information today.

gb®

GUSTIN-BACON
Manufacturing Company
220 West 10th St., Kansas City, Mo.

WEINMAN PUMPS
give Florida Bank Building
PERFECT WEATHER
in every office

One of the South's most modern banking facilities, The First National Bank of Orlando, features functional design in brick, glass and marble with dramatic horizontal and vertical lines. Architect: Kemp, Bunch and Jackson, Jacksonville, Fla.; Consulting Engineer: VanWagenen, Taylor and VanWagenen, Jacksonville; General Contractor: Sipple, Thompson and Street, Orlando, Fla., and Mechanical Contractor: Wrenn Brothers, Rock Hill, South Carolina.

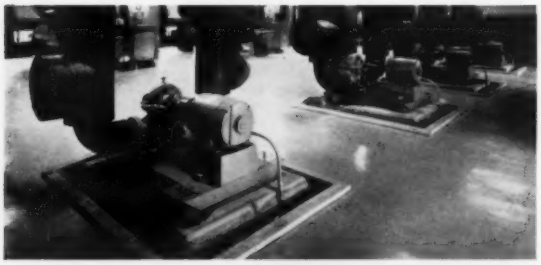
Like many another user, officials of The First National Bank of Orlando have found Weinman Pumps exceed requirements for efficient, economical, low-maintenance pumping. To solve *your* pumping problem, call your Weinman Centrifugal Specialist today . . . he's in the Yellow Pages. Or, if you prefer, write us direct.

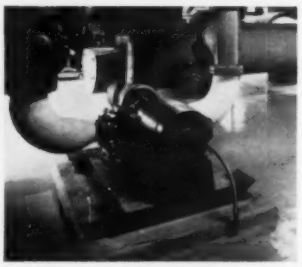
The First National Bank Building, with its blank north and south walls, provides downtown Orlando, Florida, with a striking new landmark. Bank facilities occupy the first four stories of the 160,000 square foot structure. The other eight floors provide modern, spacious quarters for many of Orlando's business and professional people.

And . . . in Florida . . . air conditioning is important. That's why the First National Bank of Orlando depends on a 2-unit, 550-ton Carrier Hydronic System to give the bank perfect year 'round climate no matter what the weather is outside. And, that's why each Carrier unit relies on a Weinman Pump for instant and efficient circulation of chilled (45°F.) or hot water throughout the system. A Weinman Pump also delivers chilled water to the primary air fan for precision control of humidity at 55°F. Still another Weinman Pump (with standby) circulates water continuously through the system's chill water loop.

And, other offices in the First National Building get the same ideal climate from one of 389 Carrier modular, under-window units that permit individual offices to "dial" the weather they want without effecting any other office. Two Weinman Pumps deliver hot or chilled water instantly to each of these units upon demand.

In addition, two Weinman Duplex Condensate Return Units provide the First National Bank Building with fast, efficient steam condensate return and a Weinman Non-Clog Type Pump removes sanitary waste and basement seepage.





Note the neat installations of some of the 12 Weinman Pumps used for circulating hot and chilled water through the 12 story building's air conditioning system.

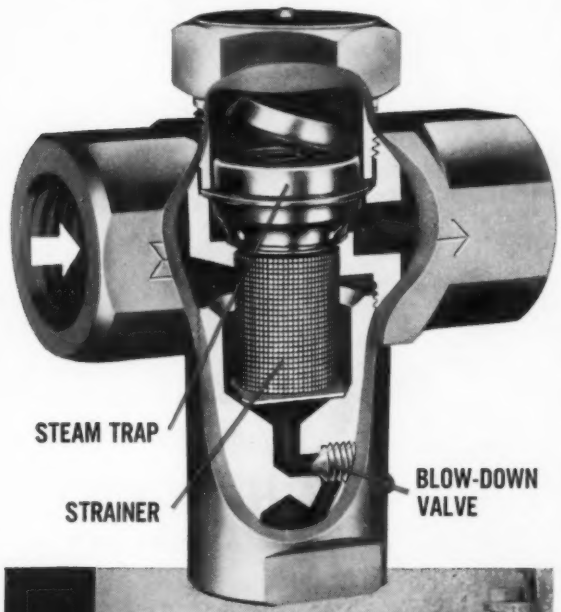
THE WEINMAN PUMP MFG. CO.
290 SPRUCE STREET COLUMBUS 15, OHIO
CENTRIFUGAL SPECIALISTS

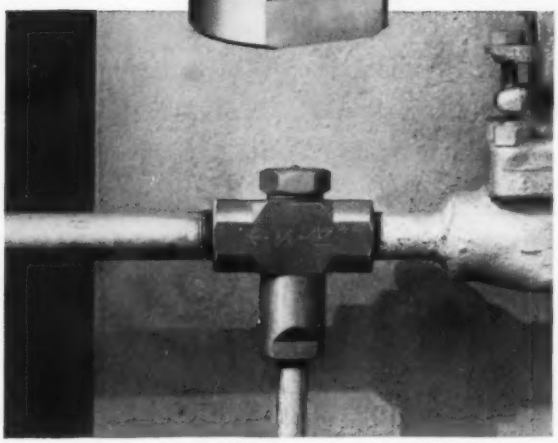
YARWAY news briefs

from **Yarnall-Waring Company,** *Philadelphia 18, Pa.*

BRANCH OFFICES IN 19 UNITED STATES CITIES • SALES REPRESENTATIVES THROUGHOUT THE WORLD
STEAM TRAPS STOCKED AND SOLD BY 270 LOCAL INDUSTRIAL DISTRIBUTORS

3 REASONS WHY NEW YARWAY SERIES 130 IMPULSE STEAM TRAP SCORES BIG SUCCESS





This new Yarway all-in-one combination steam trap, strainer and blow-down valve—designed especially for moderate condensate load applications—is winning enthusiastic approval from users everywhere. Here's why:

it saves space

Entire trapping hook-up can fit into an area no larger than a "T" fitting. Straight-through piping, cleaner installations, more accessibility.

it saves money

Only one unit to buy—plus much lower installation and maintenance costs—results in large savings over conventional trap installations. A fair estimate—*UP TO 30% IN TIME AND MATERIALS!*

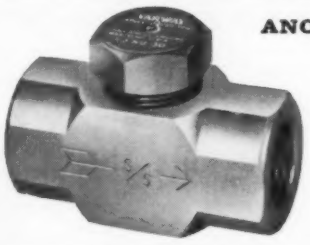
it saves work

No more installation headaches. As easy and quick to install as a pipe fitting. Maintenance is a breeze. Blow-down valve is operated by simple Allen wrench.

SERIES 130 traps are good for all pressures 8 to 600 psi, stainless steel throughout, have replaceable trap valve and seat, woven stainless steel strainer.

Why not try this compact combination on a steam main drip, tracer line or other moderate load application in *your* plant? Your nearby Yarway distributor can now supply you. For more details on Yarway Series 130 traps, write for Bulletin T-1743B.

Yarway Series 130 Impulse Steam Trap draining drip on 700 ft. house heating line at Eddystone Station of Philadelphia Electric Co. Pressure 150 psi; temperature 385° F.



ANOTHER POPULAR YARWAY IMPULSE STEAM TRAP—SERIES 30

This is the "trap" part of the Series 130 described above—but without combined strainer and blow-down valve. Gives peak efficiency on moderate condensate load applications. Offers these features:

- Economy of operation, with close condensate control
- Long service life, with lever action reducing impact in valve seat
- Low maintenance; easily replaceable seat and disc
- High quality, all stainless steel—with a new *low cost*

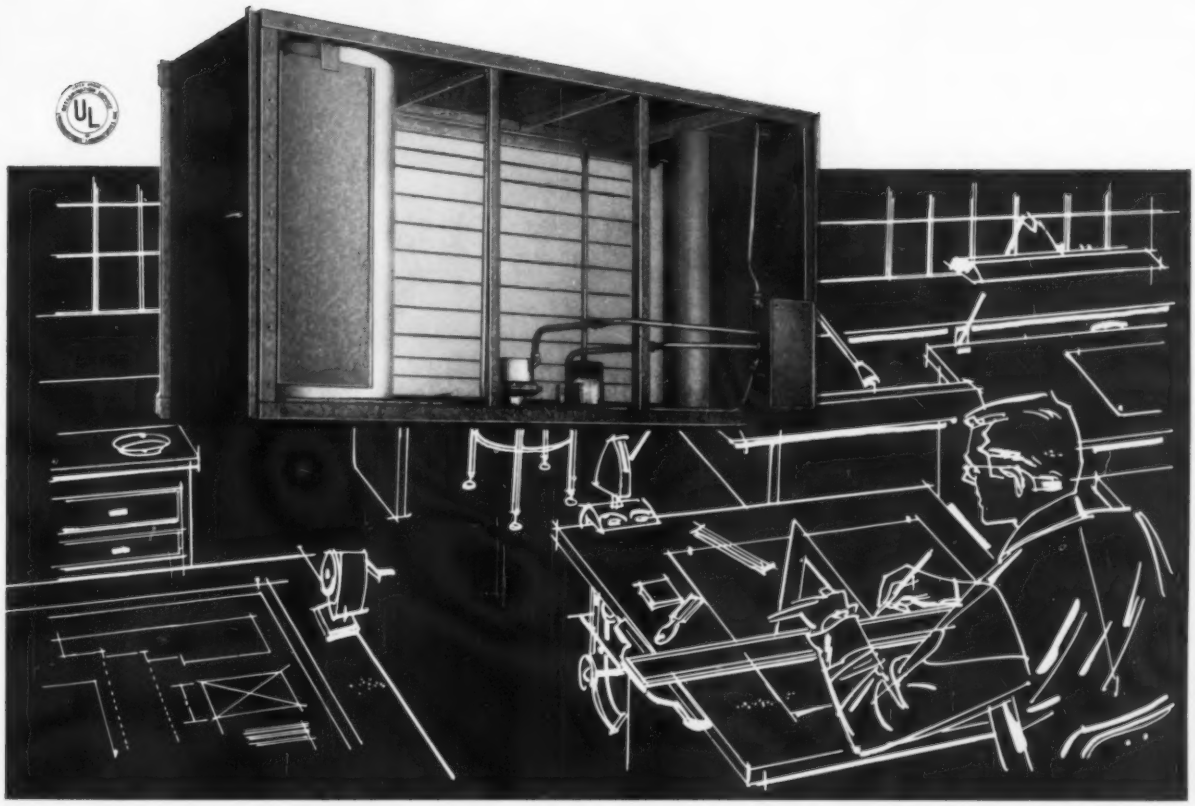
Write for Yarway Bulletin T-1743.

Lock seaming ceases to be a problem when you use Weirkote® Zinc-Coated Steel. This modern continuous-process tightly bonded zinc-coated steel won't peel, chip or flake. Work it to the limits of the steel base itself and the zinc coating remains intact assuring you of the complete corrosion protection that only zinc can give. A representative will be happy to supply more complete information on Weirkote—another fine product of both Weirton Steel and Midwest Steel.

MIDWEST STEEL
Portage, Indiana

WEIRTON STEEL
Weirton, West Virginia

divisions of
NATIONAL STEEL CORPORATION



CONOMATIC "TYPE GH" *Horizontal Roll Filter . . . .*

TO MAKE YOUR AIR SYSTEM TOTALLY AUTOMATIC!

Continental *creative* engineering has provided, in the CONOMATIC, a factory-assembled, automatic air filter that means real savings in construction, and assures superior operation of equipment on the job.

This automatic roll-type air filter will insure peak performance of your installation at all times and is virtually maintenance-free. May we show you how our Horizontal CONOMATIC will guard the efficiency of your equipment in service? Ask your Continental Agent or write us at P. O. Box 1647, Louisville 1, Ky., for Bulletin 822-A.

Clean Air Costs Less with Continental!

- Matches the job. 225 Sizes to choose from.
- Capacities from 3,340 to 66,300 cfm.
- Services access from front or end—select to suit your job.
- "Ready-to-run" when delivered to you. Completely assembled. Completely wired.
- Underwriters Listed—for safety, for quality.
- Galvanized and/or cadmium-plated throughout.
- Totally-enclosed drive motor, with built-in overload protection.
- Control choices: either timers or pressure switches.
- CONOMATIC Vertical Type "G" also available.

C A F CONTINENTAL AIR FILTERS, INC.
LOUISVILLE 1, KENTUCKY

Ruberoid offers a *full line* of quality insulation, covering virtually every industrial application. Check this page for *your* needs!

RUBEROID Calsilite® Insulation

Calsilite—for temperatures up to 1250°F.

Calsilite-Hi—for temperatures up to 1800°F.

Strong, pre-molded insulation for power and process piping, equipment. Initial cost low . . . application cost minimal. Calsilite cuts and mitres smoothly . . . easily. Provides neat appearance with minimum upkeep. Available in pipe covering, block, and three-segmental forms in wide range of sizes and thicknesses.

RUBEROID Fiber Glass Duct Insulation—*Thermal:* all-temperature wrap-around. *Acoustical:* liner, keeps duct systems quiet. Both available in compression-packed rolls . . . can be furnished with facing of aluminum foil, vinyl, or reinforced asphalt laminated paper.

RUBEROID Fiber Glass Pipe Insulation—For low-pressure applications. Economical and easy to apply. Furnished in 3-foot lengths—with or without various jackets, in variety of sizes and thicknesses.

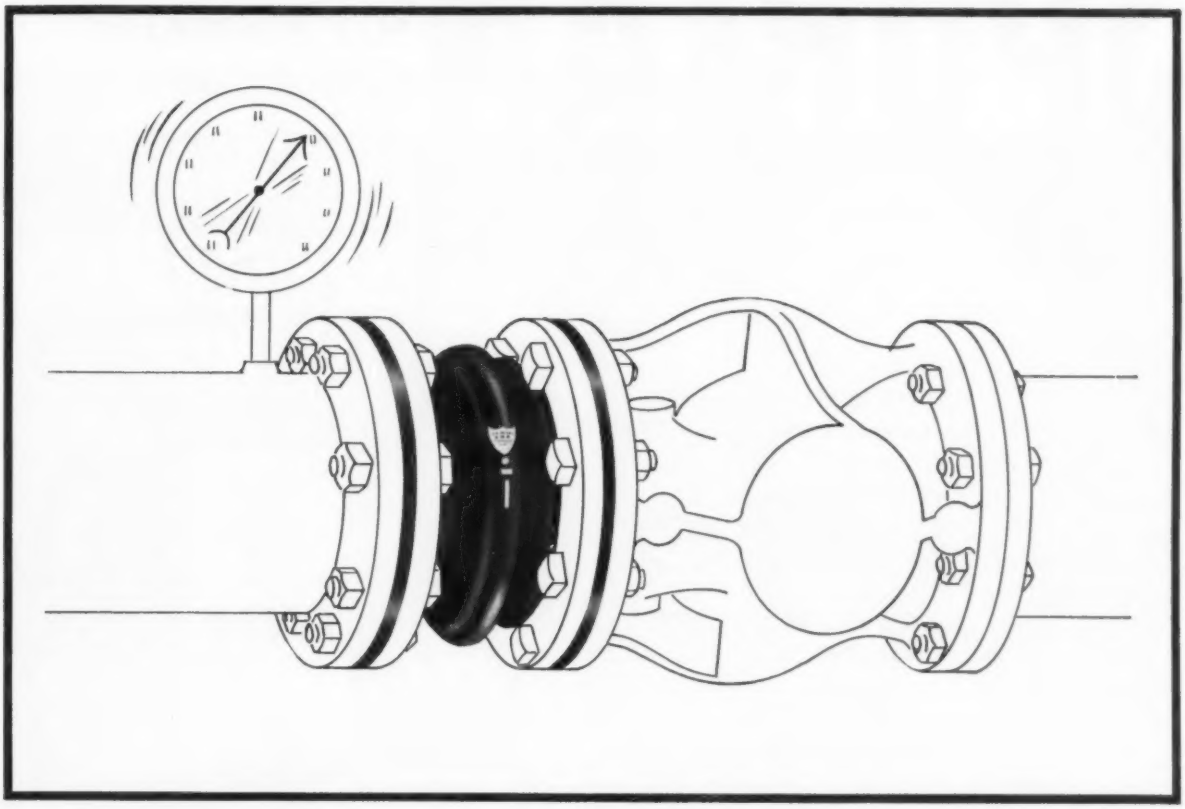
RUBEROID Cements—the *perfect* teammates for Ruberoid insulation. Choose Mineral Wool Cement . . . Calsilite Cement . . . Single Coat Cement . . . Asbestos Cement.

Write today for illustrated brochures and facts about our technical assistance.

The RUBEROID Co.

INDUSTRIAL INSULATION DIVISION
733 THIRD AVE., NEW YORK 17, N. Y.

US RUBBER EXPANSION JOINTS



U.S. AMR Expansion Joints

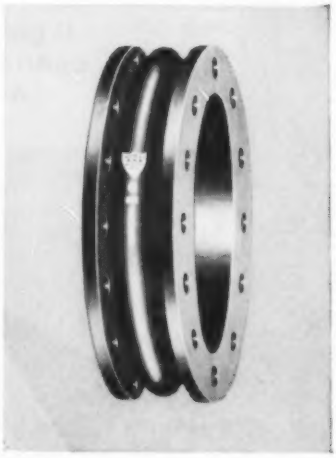
handle even the highest surge pressures safely

Today's power and processing systems require piping that withstands flow surges, high pressures, and high temperatures unheard of a few years ago. Going hand in hand with improved piping is the simultaneous demand for better expansion joints.

U. S. Rubber . . . the company that brought you the *first* rubber expansion joint . . . now brings you the new AMR expansion joint, designed to meet today's most rigid requirements.

The AMR Expansion Joint:

- Has a new, patented inner construction with built-in *surge* protection for increased service life.
- Withstands higher continuous working pressures—pressures that exceed even the capacity of conventional wire-armored expansion joints.
- Has the flexibility of standard joints.
- Is available now in materials for handling corrosive chemicals and/or wide temperature ranges.



Your "U. S." representative will call at your request to give you the full facts and samples of this revolutionary development in rubber expansion joints. Why not call him . . . or write US at Rockefeller Center, New York 20, New York.

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

US RUBBER **United States Rubber**

MECHANICAL GOODS DIVISION

SPORLAN

offers the most complete line of
PEAK PERFORMANCE PRODUCTS FOR

AMMONIA REFRIGERATION SYSTEMS

THERMOSTATIC EXPANSION VALVES
and
REFRIGERANT DISTRIBUTORS
for Direct-Expansion Systems

LEVEL MASTER CONTROLS
for Flooded Systems

SOLENOID VALVES

Be sure to get
SPORLAN CATALOG 59A
from your friendly Sporlan Wholesaler
It gives you all the facts on
Sporlan Peak Performance
Ammonia Products

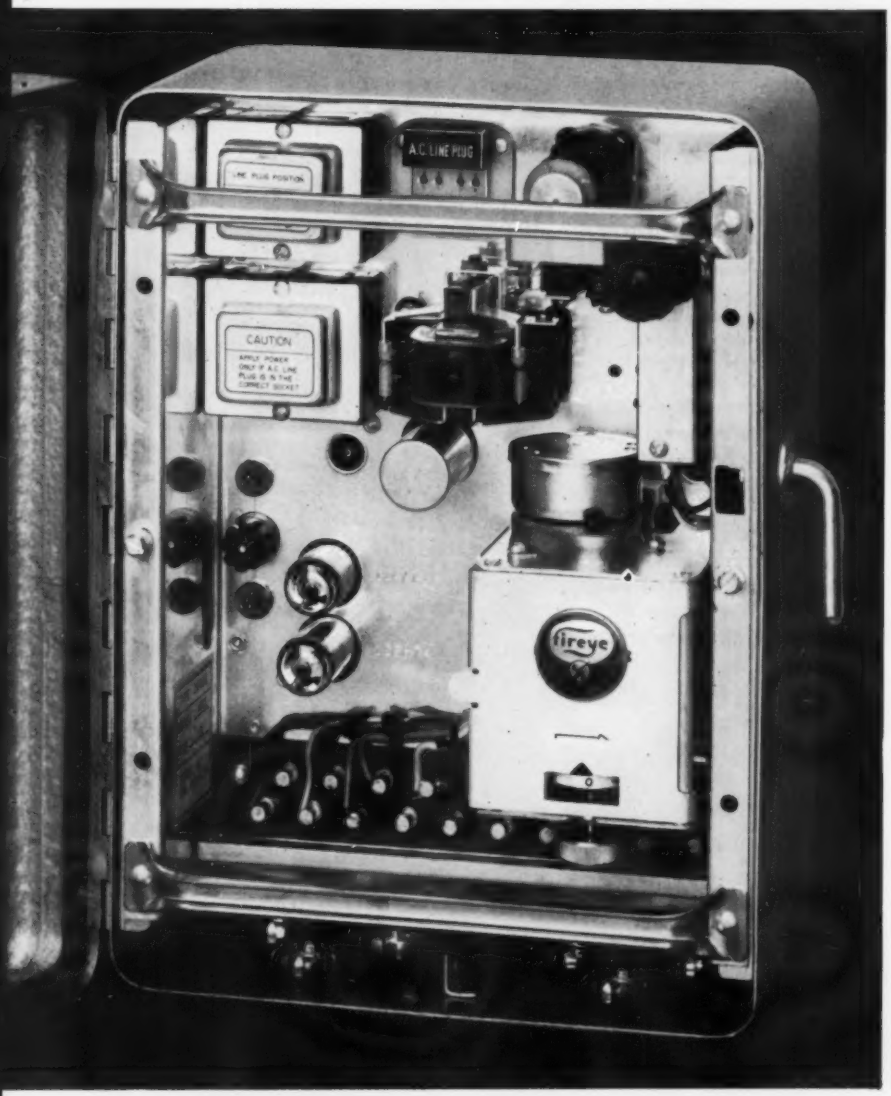
CATCH-ALLS

STRAINERS

BACK PRESSURE REGULATORS

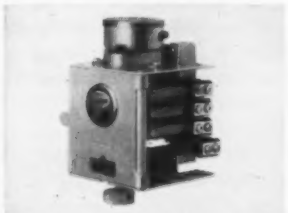
SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE · ST. LOUIS 14, MISSOURI
EXPORT DEPT., 85 BROAD ST., NEW YORK 4, N. Y.

NOW...An Important Advancement in FIREYE Systems

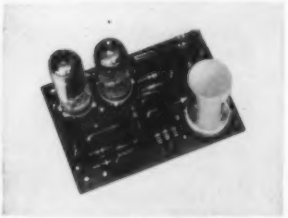


for
Flame Safeguard
and Programming
Control

You get all these Extra Features at No Extra Cost



1 — SYNCHRONOUS MOTOR TIMER
No electronics in this critical part. Timing is not influenced by line voltage variations.



2 — PRINTED CIRCUIT BOARD
eliminates complex wiring. Connections are dip soldered for trouble-free operation.

3 — IMPROVED ELECTRONIC CIRCUIT
requires fewer tubes.

4 — NEW FUSED FUEL VALVE CIRCUIT
provides an additional safety factor.

5 — NEW COLD SAFE START CHECK
provides a circuit check on every cycle from the moment the control is powered. Also checks operation of flame relay.

6 — NEW MULTI-VOLTAGE LINE PLUG
Connections provided for 120v., 208v., 240v.

Long rated best by those who know most about protection systems for automatic burners . . . the choice of 9 out of 10 burner-boiler manufacturers . . . the famous FIREYE FP-2 now is even more reliable and convenient.

You'll find many important advancements in this new model FP-2. But there is no change in the basic design and outstanding quality which have won your favor through the years.

You get the Firetron infra-red sensitive cell for visual supervision of both oil and gas flames. Perfected and proved in a half million installations, the Firetron scanner has no equal.

You get rugged construction and a control that's easy to understand, install and service.

You get completely approved protection . . . whatever the Codes call for, Fireye performs in fullest measure.

The new FP-2 system, Model 6018, is completely interchangeable with the former model. WRITE FOR informative Bulletin CP-51. Combustion Control Division, Electronics Corporation of America, One Memorial Drive, Cambridge 42, Mass. In Canada: Electronics Corporation of America (Canada) Ltd., 104 Advance Road, Toronto 18, Ontario.

E C A fireye

Here Your Motor Starter Dollar Buys

MORE OF THE QUALITIES YOU NEED

BULLETIN 709 SIZE 3
across-the-line solenoid starter in Nema Type 1 enclosure.

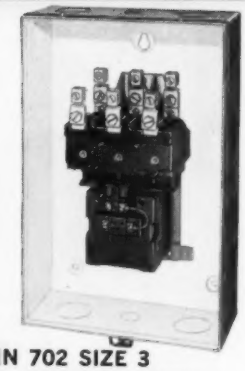
Where else could you possibly obtain—in one complete line—all of the desirable features of the ideal motor control...

1. **Smaller size**
2. **Greater reliability**
3. **Remarkable switching capacity**
4. **Longer life**
5. **Conscientious overload protection**
6. **Simpler installation**
7. **Complete accessibility**
8. **Beautiful appearance—either open or enclosed**
9. **Surprising light weight**

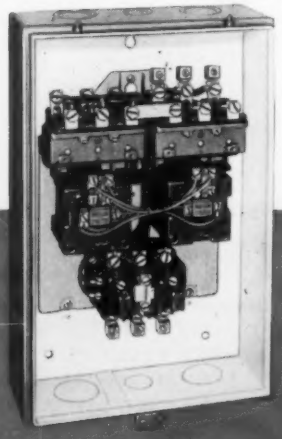
The heart of this new line of magnetic motor starters is the unique solenoid contactor. While it retains the famous A-B one-moving-part principle, it is completely new and far more efficient. This fact is reflected in reduced dimensions for all of these controls. Yet, this contactor design will perform reliably for many more *millions* of trouble free operations.

The new enclosures are very "eye appealing." When the open type starters are assembled into special panels, their neatness and compactness will delight the designers. Full details are in Publication 6100. Please write: Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

A-B QUALITY

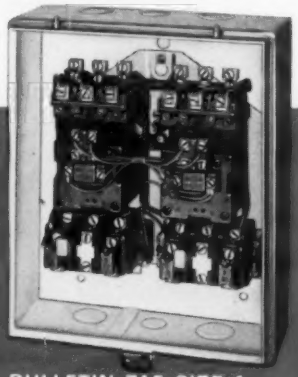


BULLETIN 702 SIZE 3
three-pole, a-c solenoid contactor in Nema Type 1 enclosure.



BULLETIN 705 SIZE 2
across-the-line reversing starter and overload relays in Nema Type 1 enclosure.

BULLETIN 712 SIZE 2
combination starter in Nema Type 1 enclosure.



BULLETIN 715 SIZE 1
across-the-line, two-speed starter—with two overload relays per speed—in Nema Type 1 enclosure.

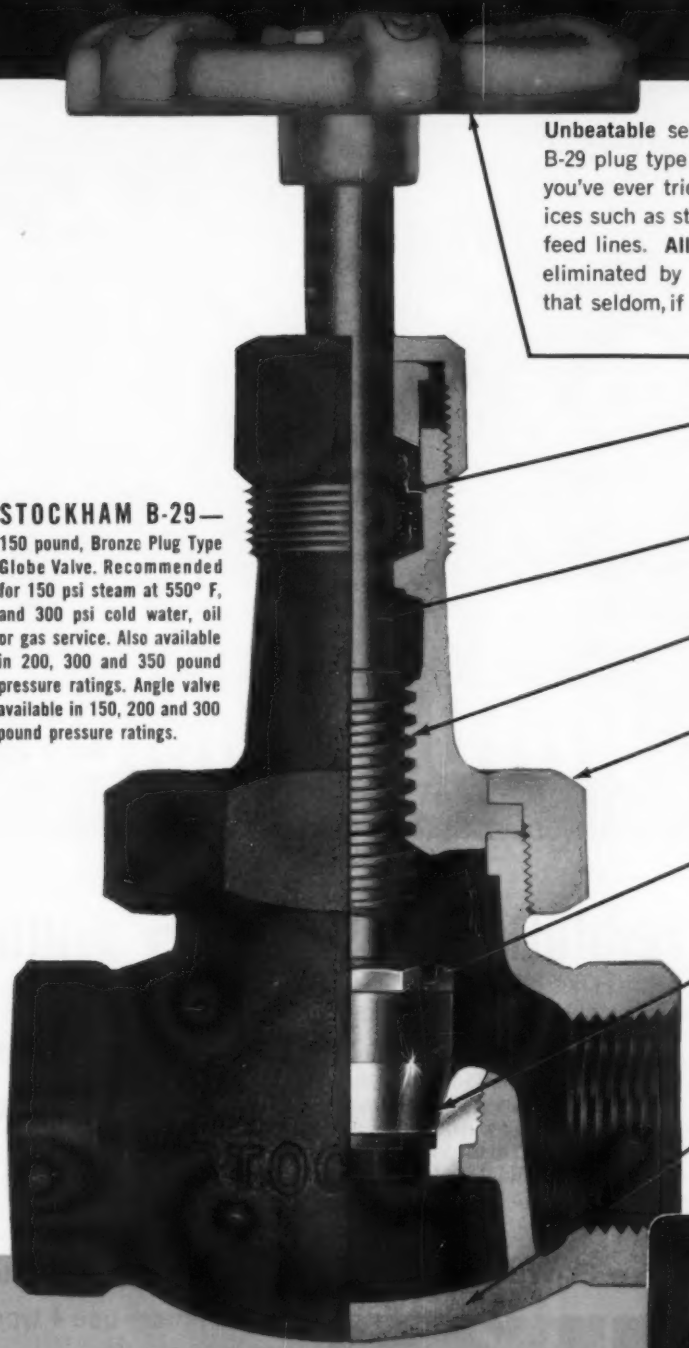
ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

TRY ONE ON YOUR TOUGHEST SERVICE

and discover what dependability means...



Unbeatable service is built into **every** feature of Stockham's B-29 plug type bronze globe valve. It will **far outlast** any valve you've ever tried... even in the most severe valve-killing services such as steam throttling, drain or blow-off lines and boiler feed lines. **All** the common causes of valve failure have been eliminated by amazingly superior alloys and design features that seldom, if ever, need maintenance of any kind. Examples...

HANDWHEEL
Easy grip, non-slip, non-heating.

STUFFING BOX
Extra deep design, completely machined, accommodates more packing for tighter seal, longer packing life and less repacking. Can be repacked under pressure in full open position.

BESTALOY STEM
Extra large diameter aluminum-silicon bronze alloy stem is by far the longest wearing in the industry.

STEM THREAD ENGAGEMENT
Extra heavy acme stem threads and complete stem thread engagement assure maximum stem life.

UNION BONNET
Rugged, heavy duty body-bonnet connection, best type to resist line strain and give added strength for severe operating conditions. Easiest type to dismantle and reassemble, without danger of injury to body-bonnet bearing surfaces.

DISC LOCKNUT
Made of hardened stainless steel, far superior to bronze. Highly resistant to abrasive wear caused by disc rotation; offers maximum corrosion resistance.

STAINLESS STEEL PLUG TYPE DISC & SEAT
Heat treated to 500 Brinnell hardness for maximum resistance to galling, abrasion or wire drawing. Can be reground or renewed. Tapered plug type design best for steam throttling and close regulation. Far superior to flat type disc design.

BODY
Designed for minimum pressure drop. Extra heavy ribbed design gives maximum resistance to line strain.

STOCKHAM B-29—
150 pound, Bronze Plug Type Globe Valve. Recommended for 150 psi steam at 550° F, and 300 psi cold water, oil or gas service. Also available in 200, 300 and 350 pound pressure ratings. Angle valve available in 150, 200 and 300 pound pressure ratings.

STOCKHAM
VALVES *and* FITTINGS

STOCKED BY YOUR LOCAL STOCKHAM DISTRIBUTOR

Bronze, Cast Iron, Ductile Iron, Cast and Forged Steel Valves — Wedgeplug Non-Lubricated Plug Valves — Cast Iron, Malleable and Ductile Iron Pipe Fittings

General Offices and Plant
4000 10th AVENUE, NORTH • BIRMINGHAM, ALABAMA

Now! Any old electric hammer is worth $60 or more trade-in

on a New Skil ROTO-HAMMER

...the hammer that revolutionized masonry drilling

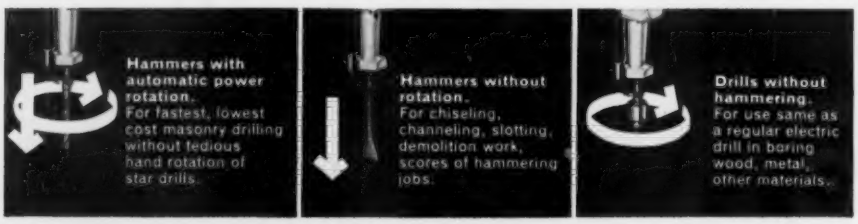
Your Skil distributor is ready to give you a whopping big trade-in allowance on a new Skil Roto-Hammer—*the fastest, easiest, lowest cost way to drill masonry holes!* You'll actually receive $60 or more worth of Skil Hammer accessories as your trade-in for any old electric hammer, regardless of make, model or condition.

Two Roto-Hammer models are available —new, improved Model 726 (drills masonry holes from 11/64" to 1½" diameter); Model 736 (drills masonry holes from ½" to 3½" dia.).

See your Skil distributor NOW for complete information. *But hurry! This sensational trade-in offer is for a limited time only!* Look under "Tools—Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 134I, Elston Avenue, Chicago 30, Illinois.

SKIL POWER TOOLS

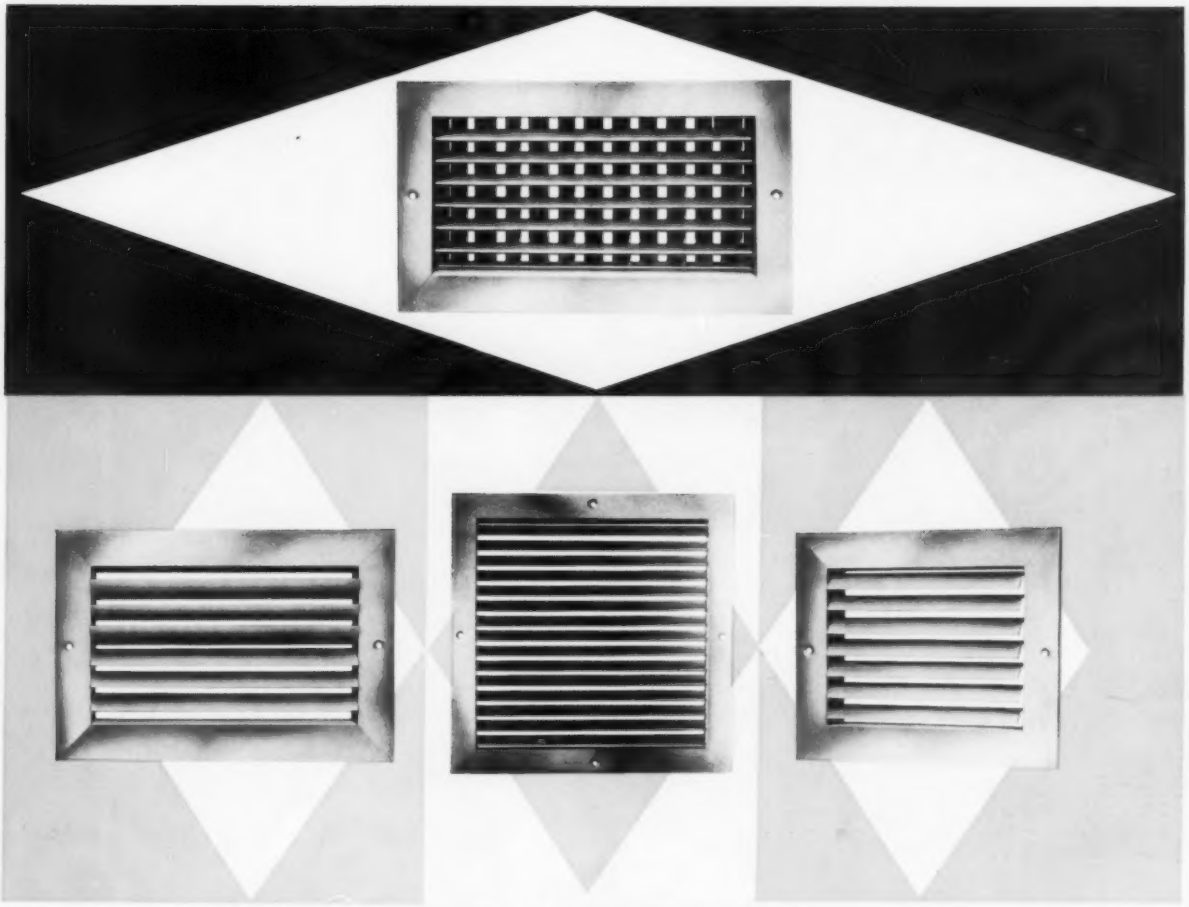
Only Skil Roto-Hammers have 3-way action


Hammers with automatic power rotation. For fastest, lowest cost masonry drilling without tedious hand rotation of star drills.
Hammers without rotation. For chiseling, channeling, slotting, demolition work, scores of hammering jobs.
Drills without hammering. For use same as a regular electric drill in boring wood, metal, other materials.

...and only Skil Roto-Hammers use 4 types of percussion-rotary bits...over 150 accessories in all for unequalled versatility!

STANDARDLINE

extruded aluminum grilles and registers withstand even salt air environment



YOU CAN COUNT ON STANDARDLINE
grilles and registers to retain their "just-installed" appearance even in the most destructive environments. All parts are of extruded aluminum . . . far stronger than rolled aluminum . . . and are impervious to rusting, pitting, corrosion . . . even in salt air.

Surfaces are etched to a rich lustre and coated with a clear acrylic lacquer. The fine finish serves as a perfect base for color-matching grilles and registers to an existing decor, without fear of "bleed-through" or need for a prime coating.

There is a T&B STANDARDLINE grille or register designed to fill the bill for your jobs. For more information, call your nearest T&B Representative or write us direct.

TUTTLE & BAILEY

Division of Allied Thermal Corporation
New Britain, Connecticut
Tuttle & Bailey Pacific, Inc., City of Industry, Calif.

At Diebold, Inc., a total of 300 Perfection Schwank Gas *Infra-Red Heaters maintain a constant 70° in 11*

Diebold Cuts Heating Costs 35%...with

"We know it sounds impossible, but our Perfection Schwank *Gas* Infra-Red Heating System has reduced heating costs 35%," says William Roby, Assistant Plant Engineer at Diebold, Inc., Canton, Ohio. "Heating comfort alone would have justified our investment, but here's the clincher. In another 2½ years, our tangible savings in heating costs will have completely paid for the entire *gas* infra-red system! Gas keeps the *fuel* cost low. And there are practically no maintenance costs."

"It's as simple as this . . . in the Fall we turn the *gas*-fired system on . . . and in the Spring we turn it off. In nearly two full heating seasons, our total heating maintenance was a single dusting of the *gas* infra-red heaters. The *gas*-fired Perfection Schwank System keeps materials, floors, and machinery at a constant, uniform 70° — *an ideal temperature for employees.* What's more, the system is completely noiseless and draftless; prevents corrosion and maintains humidity at an optimum level for efficient production."

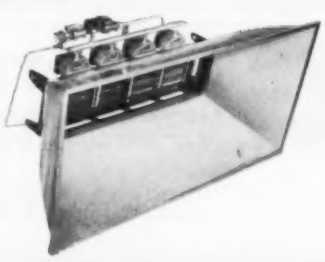
uninsulated buildings with total floor space of 180,500 sq. ft. and a total volume of 6,500,000 cu. ft.

Perfection Schwank **Gas** Infra-Red Heaters

As over 30,000 users have discovered, Perfection Schwank *Gas* Infra-Red Heaters give all the advantages of modern *gas* heat... high efficiency, precise control, speed, safety, cleanliness, dependability and unbeatable fuel economy.

Heat better for less with Perfection Schwank *Gas* Infra-Red Heaters. For complete information, contact your local Gas Company or write to Perfection Division of Hupp Corporation, licensee of American Infra-Red Radiant Co., 1135 Ivanhoe Rd., Cleveland 10, Ohio.

American Gas Association.



Approved by A.G.A., Underwriters, C.G.A. and C.S.A. Under Schwank U.S. Patents 2,775,294 and 2,870,830 and pending applications.

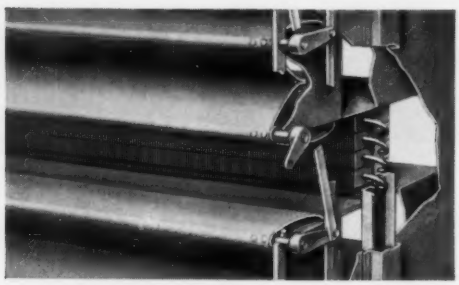
FOR INDUSTRIAL HEATING ...GAS IS GOOD BUSINESS!

NEW WING *IFB HEATER SECTIONS

for freeze proof air conditioning, preheating and tempering applications

*Integral Face By-Pass

Steam, hot water or high temperature hot water operated Wing *IFB Heater Sections permit simple, low cost, freeze proof installations in any central air conditioning system. Temperatures, controlled without throttling steam are uniformly maintained. Modulating steam valves or multiple coils are not required. Non-stratified air delivered three feet downstream of section eliminates need for extensive duct work normally required for mixing purposes. Thermostat sensing bulb location problems are simplified. Wide range of sizes up to 35,000 CFM, 24 sq. ft. of face areas from single section.



Constant Pressure "Air-flow-Line Dampers"

The V-type "Air-flow-Line" dampers maintain a constant pressure drop across the *IFB Heater Section regardless of damper position. Constant air flow resistance is maintained. Fan horsepower requirements can be held to a minimum.

WC 163

WRITE FOR BULLETIN IFB-61

WING

L. J. WING MFG. CO.
DIVISION OF AERO-FLOW DYNAMICS, INC.
140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
FACTORIES: LINDEN, N.J. AND MONTREAL, CANADA

PORTRAIT OF DEPENDABILITY

Undisturbed cobwebs tell a powerful story! Day in and day out, OIC steel valves take strain, vibration, pressure changes and shock in their stride. From the outside you get no hint of the precise manufacturing tolerances that make this trouble-free performance possible. OIC steel valves are designed to handle your steam, chemicals or hydrocarbons with minimum maintenance and maximum cost savings. Of this you can be sure . . . OIC steel valves are built to operate with complete dependability.

THE FINEST VALVES AND DISTRIBUTOR SERVICE FROM OIC

OIC VALVES

BRONZE, IRON,
FORGED STEEL,
CAST STEEL AND
DUCTILE IRON VALVES

INDUSTRIAL DISTRIBUTORS

THE OHIO INJECTOR COMPANY, WADSWORTH, OHIO

The Ohio Injector Company 10818-OIC
235 Main Street, Wadsworth, Ohio.

Your story interests me. Please send more information about valves used in my industry.

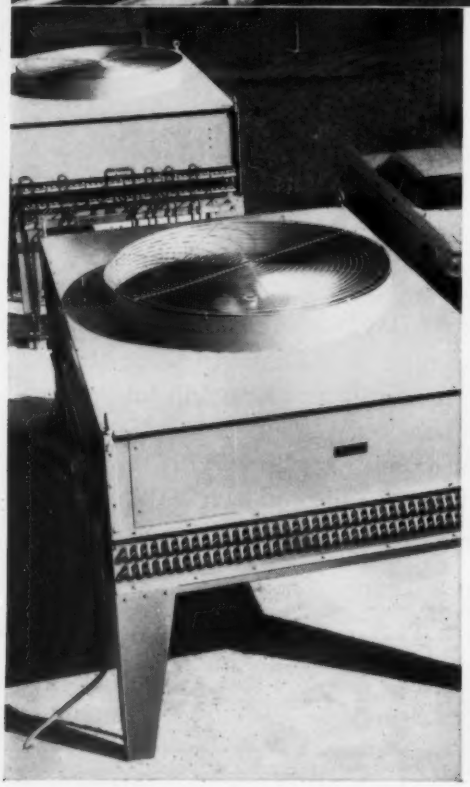
Name _____

Company _____

Product _____

Street _____

City _____ Zone ___ State _____



. . . H&M's Limitrol valve lets you use them year-round!"

"Many of my air conditioning and refrigeration systems have to operate 12 months a year. But cold weather used to raise cain with compressor-condenser balance.

"Then I learned that Halstead & Mitchell had a Limitrol pressure modulating valve that adjusts their air-cooled condenser capacity to compressor head pressure, whatever the outside temperature. What's more, H&M gives me multiple circuiting at no extra cost!"

You'd do well, too, to standardize on H&M Air-Cooled Condensers. There are propeller fan models with vertical or horizontal air discharge, and centrifugal fan models for inside installation with ductwork. Capacities of 5 to 100 tons.

Want more information? Call your parts wholesaler or write for Bulletin AC-102. Halstead & Mitchell Co., Bessemer Building, Pittsburgh 22, Pa.

Air-Cooled Condensers • Air Handlers and Coils • Cooling Towers • Water-Cooled Condensers

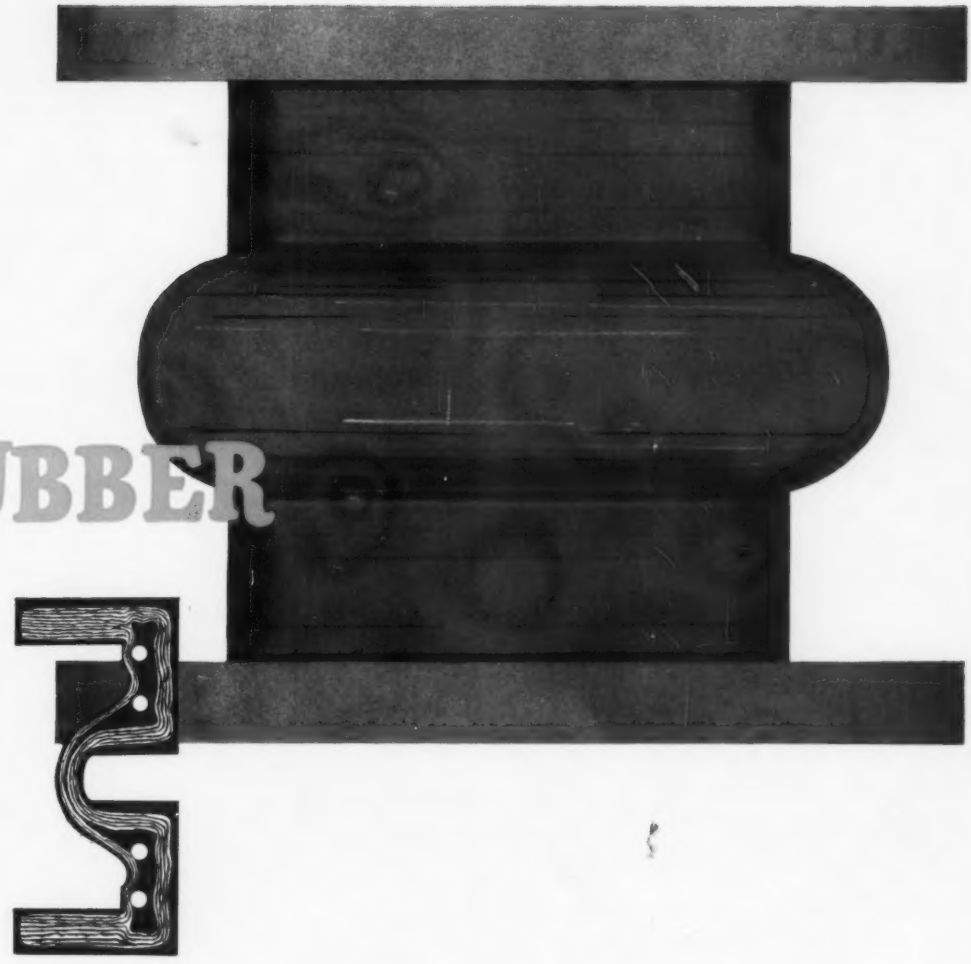
Export Representatives: Sabal-Kielmann, 15 Williams St., New York 5, N.Y.

HM

Halstead & Mitchell

YES, IT'S

RUBBER



AND **MERCER** MAKES IT

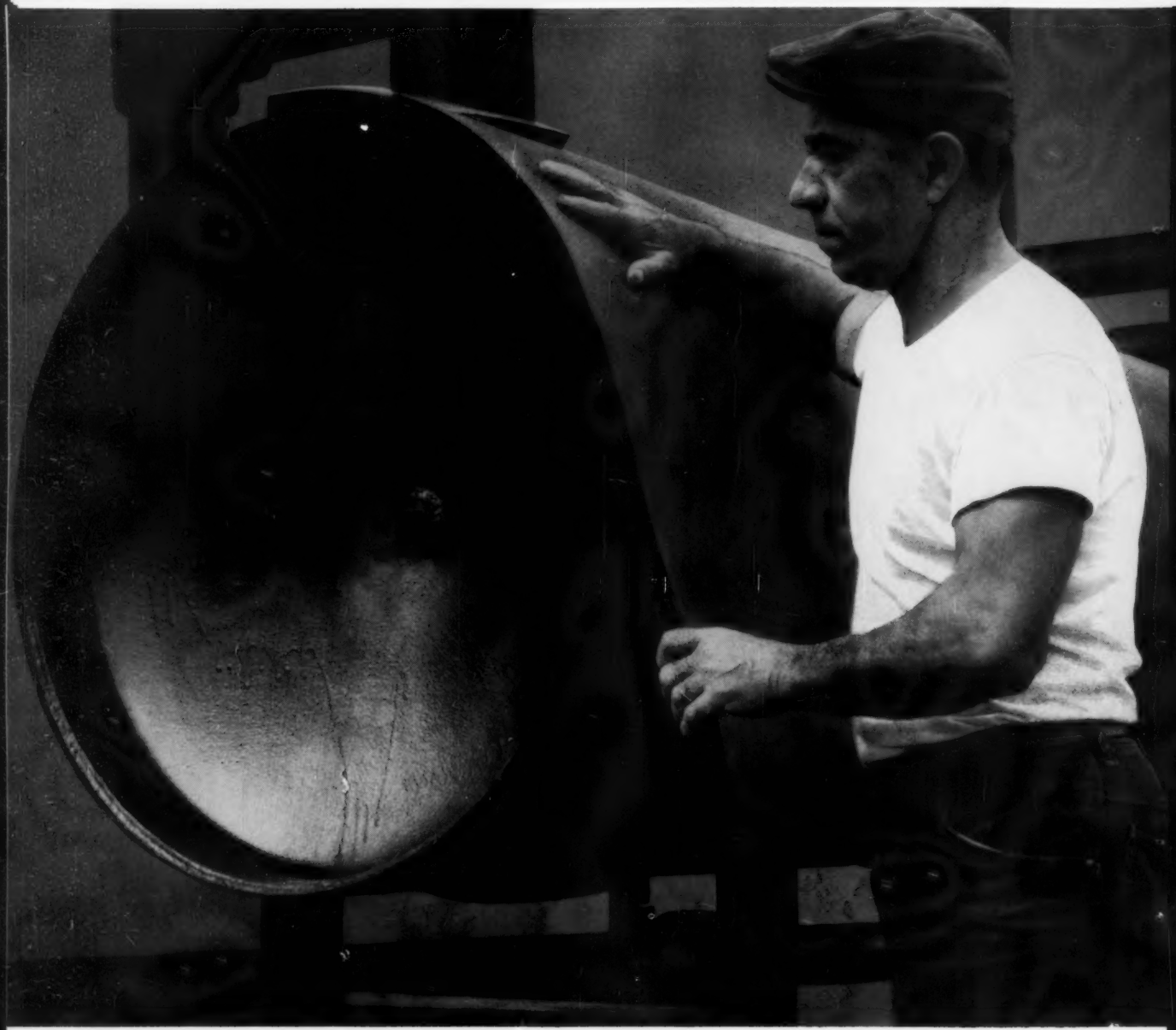
Mercer Rubber makes expansion joints to fit every need—in the widest variety of sizes—for pressure and vacuum use.

And Mercer expansion joints are *made* better—by specialists.

Every Mercer expansion joint is made to fit the job at hand. They are easy to install, practically maintenance free and fit into any piping system to absorb expansion and contraction, stop sounds at the source and reduce transmitted vibrations. They save money and extend use—life of large and small piping systems.

Have you had a piping problem related to noise, misalignment or stress? Then—before you install or replace another inch of pipe—or a pump—get all the facts on the complete line of Mercer Invincible Rubber Expansion Joints, backed by nearly a century of experience in making fine industrial rubber products. Ask for illustrated literature today.

MERCER RUBBER CO.
136 Mercer St., Trenton 90, N.J.



Armaflex sheets . . . the better, faster way to insulate large pipes, tanks and vessels

Armaflex sheets are great time-savers in the insulation of large pipes, tanks and vessels from sub-zero to 160F temperatures. Other insulations often require mechanical support, cement or mastic coatings, and expensive vapor-proof finishing. Armaflex sheets do away with these time-consuming steps. The 30″ x 36″ sheets need only be cut to fit, where necessary, and cemented in place with Armstrong 520 Adhesive. Their foamed plastic composition is an excellent vapor barrier, assuring long service, and their flexibility allows fast and efficient workmanship.

Armaflex sheets are part of a complete line of Armaflex products that includes flexible Armaflex 22 Pipe Covering, Rigid Armaflex for use where compression of insulation is a problem, and Armaflex Finish and Adhesives. For full product information and detailed specifications on all these Armaflex materials together with complete application instructions, write today to Armstrong Cork Company, 2209 Sherman Street, Lancaster, Pennsylvania.

ARMAFLEX ® IS A TRADE-MARK OF ARMSTRONG CORK COMPANY

Armstrong INSULATIONS

ARMAFLEX 22 • RIGID ARMAFLEX • ARMAFLEX SHEETS • ARMAFLEX FINISH • ARMAFLEX ADHESIVES

ONE SOURCE...
ONE RESPONSIBILITY...
FIVE SOLUTIONS TO PIPE MOVEMENT PROBLEMS
Flexonics . . . and only Flexonics offers you one responsible source to insure sound piping installations where thermal expansion and contraction, vibration, and other forms of pipe motion exist. Mail the coupon for your FREE copy of the new Flexonics Engineering Guide . . . 42 pages of pipe motion calculations, tables, anchoring and guiding data.
Corrugated Expansion Joints—Controlled and Free Flexing. Nominal pipe size to 48". Larger on special order.
Expansion Compensators—Low and high pressure models. Available in steel, all stainless steel, and bronze.
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Roller Pipe Insulating Supports—All steel, formed saddle. Pipe sizes ½" to 14". Larger sizes on special order.

KJ1260

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FLEXIBLE METAL and SYNTHETIC HOSE EXPANSION JOINTS
BELLOWS • SPECIAL TUBULAR ASSEMBLIES

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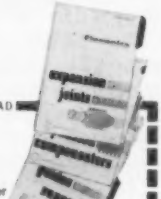

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Please send me Flexonics Engineering Guides and other information in the areas that I have checked:

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☐ Flexonics Flexible Connectors

They give air the air

For greater comfort, higher heating efficiency and long life, hydronic systems must be kept air-free.

Taco engineers have designed a family of air elimination accessories that assure peak performance, dependable operation and long life in hot water heating systems, both residential and commercial.

The TACO AIR-SCOOP installs quickly and easily right at the boiler. Air is trapped and eliminated before it can pass into the system. This exclusive, patented air scoop pays for itself by assuring long, trouble-free system operation. It also assures greater comfort by virtually eliminating noise and system blockage.

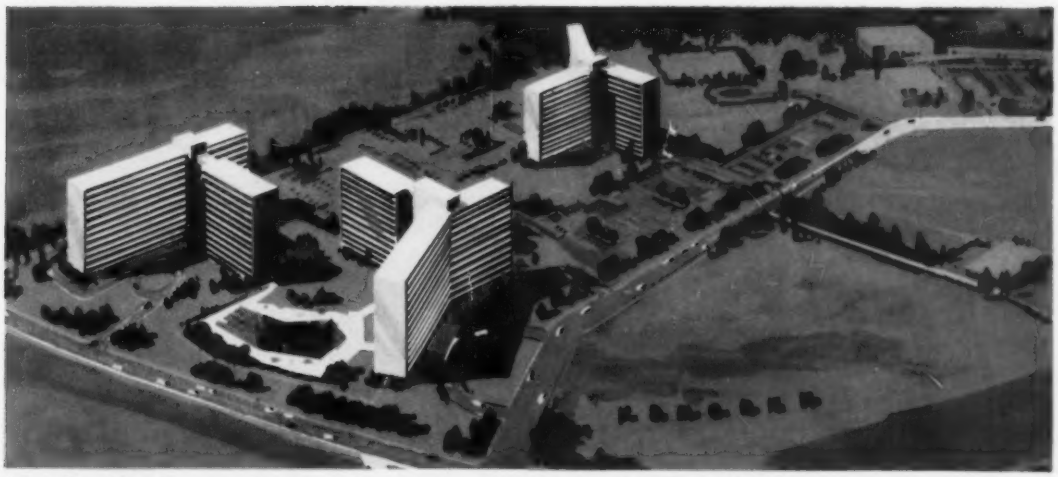
The TACO-VENT, a specially engineered hot water air valve, is installed at each radiation unit. It is completely noiseless, leak-proofed and automatic in operation. TACO-VENTS are economical, as well as easy to install. They are made in a variety of sizes for convector units, radiators and baseboards.

The TACO HY-VENT is especially designed for installation at all high points in the hydronic system. The exclusive design permits fast, large capacity venting.

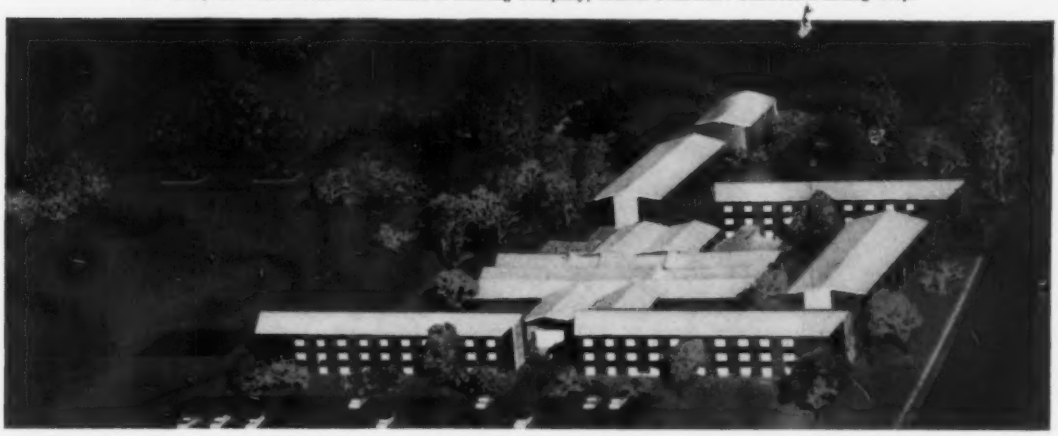
In short, Taco accessories assure extra long system life, save fuel costs for the user and win customer satisfaction for the heating contractor. For complete details on these and all Taco products, contact your local wholesaler or write TACO HEATERS, INC., 1160 Cranston St., Cranston 9, Rhode Island.

Taco

EFFICIENCY ENGINEERED PRODUCTS



Cooper River Plaza Apartments Pennsauken, N.J. (one unit completed) *Architect:* John Hans Graham & Associates, *Mechanical Contractor:* Daniel J. Keating Company, *General Contractor:* Oakwood Building Corp.



Dormitories, University of Delaware, Wilmington, Del. *Architect:* Howell Lewis Shay, *Mechanical Contractor:* Daniel J. Keating Company, *General Contractor:* Frank H. Wilson Co.

Prefabrication with Anaconda Copper Tube, on the site or at the shop . . .

. . . results in a faster, more compact and economical job.

Prefabrication with Copper

"a more compact and economical job"

"We like to work with copper because it not only gives our customers a top-quality job, but also because of the ease of installation it affords our men in the field. Its light weight and time-saving prefabrication possibilities afford the contractor the means to install a more compact and economical job. In brief, copper piping serves the owner and contractor best." So says Mr. D. J. Keating, Jr., President of the company which installed Anaconda copper tube for water lines and sanitary drainage in these projects.

For complete information about Copper Tube and Fittings, write Anaconda American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-977

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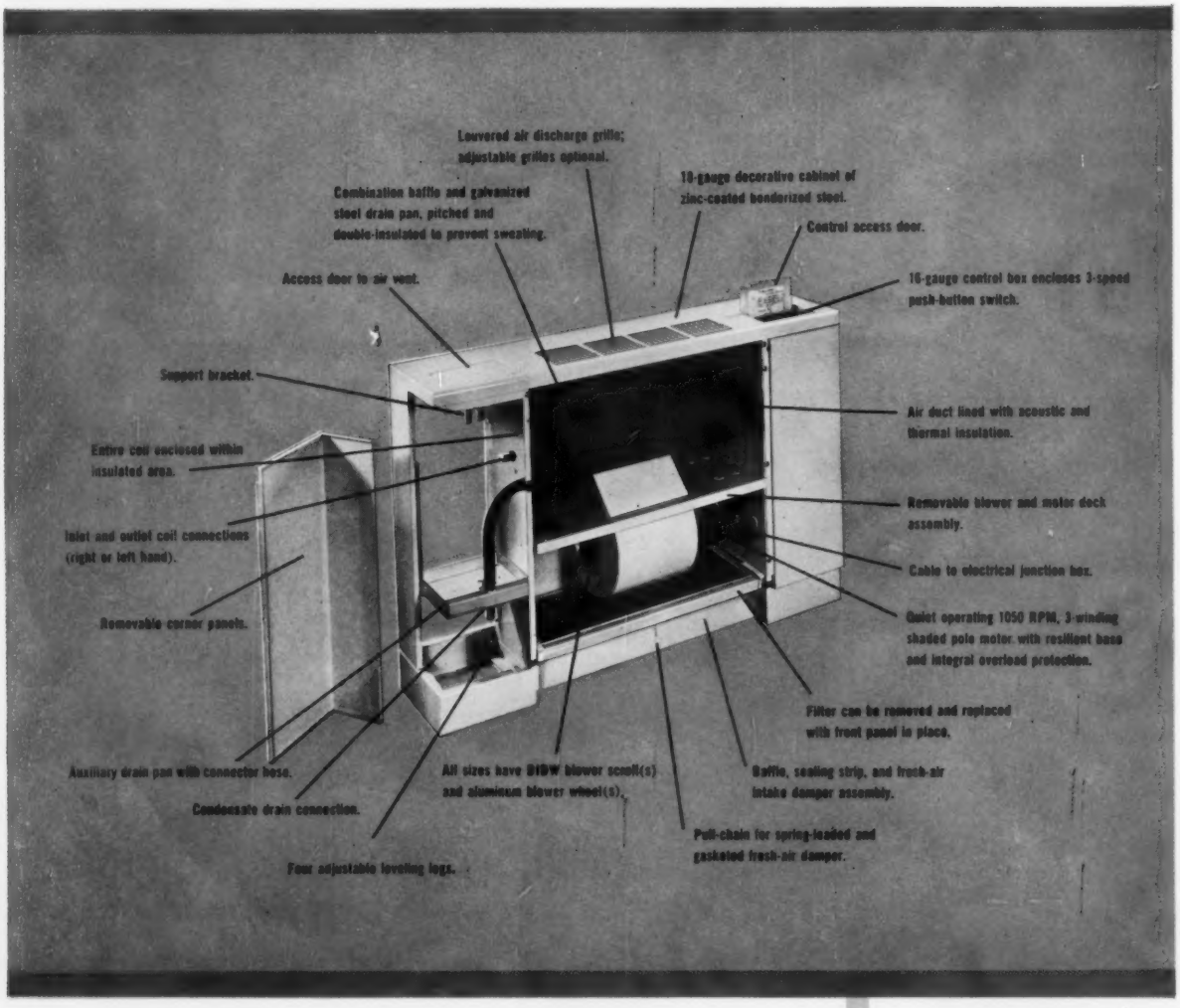
AMERICAN BRASS COMPANY

BOHN *Engineers Every Detail of the* BOHN-AIRE


Louvered air discharge grille; adjustable grilles optional.
Combination baffle and galvanized steel drain pan, pitched and double-insulated to prevent sweating.
18-gauge decorative cabinet of zinc-coated bonderized steel.
Control access door.
Access door to air vent.
16-gauge control box encloses 3-speed push-button switch.
Support bracket.
Air duct lined with acoustic and thermal insulation.
Entire coil enclosed within insulated area.
Removable blower and motor deck assembly.
Inlet and outlet coil connections (right or left hand).
Cable to electrical junction box.
Removable corner panels.
Quiet operating 1050 RPM, 3-winding shaded pole motor with resilient base and integral overload protection.
Filter can be removed and replaced with front panel in place.
Auxiliary drain pan with connector hose.
All sizes have BIDW blower scroll(s) and aluminum blower wheel(s).
Baffle, sealing strip, and fresh-air intake damper assembly.
Condensate drain connection.
Pull-chain for spring-loaded and gasketed fresh-air damper.
Four adjustable leveling legs.

Versatility and compactness in a slim 8½" width are featured in all BOHN-AIRE Models. Available for vertical mounting (7 sizes) or for horizontal mounting (5 sizes). Durable casings for concealed mounting; attractive cabinets (beige finish of baked enamel) for "in the space" installation.

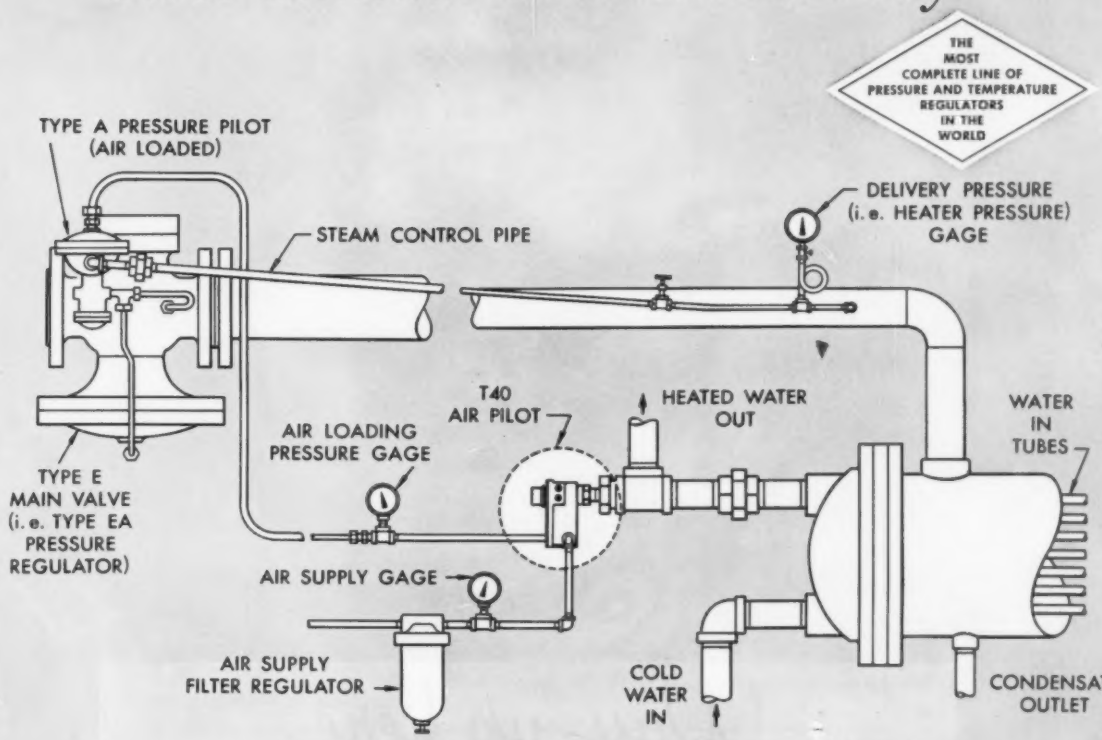
WRITE FOR BOHN BULLETIN 250 CONTAINING FULL DETAILS

BOHN *Buy the known line... the BOHN line... the first line*

ALUMINUM & BRASS CORPORATION

Danville Division • Danville, Illinois

New Spence Temperature Control System Gives Unusual Control Accuracy


THE MOST COMPLETE LINE OF PRESSURE AND TEMPERATURE REGULATORS IN THE WORLD
TYPE A PRESSURE PILOT (AIR LOADED)
STEAM CONTROL PIPE
DELIVERY PRESSURE (i.e. HEATER PRESSURE) GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
AIR LOADING PRESSURE GAGE
TYPE E MAIN VALVE (i.e. TYPE EA PRESSURE REGULATOR)
AIR SUPPLY GAGE
AIR SUPPLY FILTER REGULATOR
COLD WATER IN
CONDENSATE OUTLET

TYPE EAT40 AIR-CONTROL TEMPERATURE REGULATOR (Patent Pending)

In a recent installation the new Spence air-control temperature regulating system provided:

- ±5°F control accuracy under wide and instantaneous load swings of 210 to 80 gallons per minute.
- Up to 50% reduction in cost as compared to instrument systems of similar accuracy.

This unique cascade-type control with throttling range adjustment independent of maximum heater pressure was developed to meet today's demand for greater control accuracy.

Additional features of the new Spence Temperature Control System include:

- 200°F wide adjustable temperature range
- Adjustable speed of steam pressure change
- Over and under temperature protection
- Pressure limit control
- Fast response
- Very low air consumption
- Field reversible for heating or cooling

The Spence Type EAT Air Control Temperature System, when properly installed, will tame wide ranging, fast changing loads of instantaneous heaters and modern heat exchangers. The cascade principle plus the use of an extremely fast responding bi-metal temperature sensing element reduce time lags and provide control stability.

Here's how the new Spence system operates:

Quick response is based on a bi-metal temperature sensing element.

Temperature pilot continuously regulates a loading air pressure.

This loading signal, when applied to a pressure regulator to reflect heater temperatures, causes it to adjust the main valve as changes in load require.

Spence has also developed a new pressure control system based on this same cascade principle. This system has a control accuracy of ½ psi or better from positive pressures through the vacuum range to 30" Hg.

For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

SPENCE ENGINEERING COMPANY, INC.
Walden 1, New York

SE-148

Way up here

there is no room for doubt; equipment must be backed by longest record of successful service and consistent engineering advancement, like these

MARLEY COOLING TOWERS

that must consistently deliver 28,356 gpm of cold water to the condensers of the largest air conditioning system (9,100 tons) ever designed to serve a new commercial structure.

In selecting Marley towers as a key element in the cooling system that serves 15,000 people, the Chase Manhattan Bank building team* endorsed the precedent established by a majority of outstanding constructors: specifying MARLEY for the finest structures the country over. This specification preference is based on demonstrated reliability, guaranteed capacity and operational economy. And only the Marley line is so broad that it can pinpoint the requirements of any job with full consideration of space, weight, code restrictions and architectural compatibility.

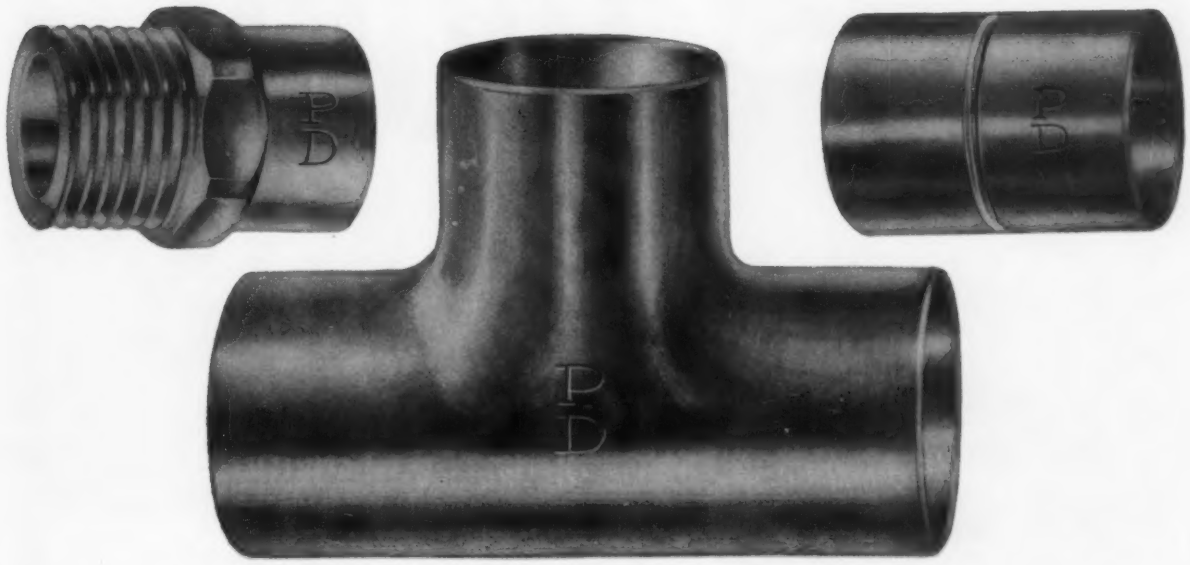
*Architects: Skidmore, Owings and Merrill *General Contractor: Turner Construction Co.
*Engineers: Jaros, Baum and Boles *Mechanical Contractor: Raisler Corp. and Kirby Saunders, Inc.

The capable Marley engineer in your city will gladly assist in selection — No obligation, of course.

THE MARLEY COMPANY • KANSAS CITY, MISSOURI

New addition to the famous Mine-to-Market Quality Line

PHELPS DODGE WROT FITTINGS for Air Conditioning and Refrigeration Tube



Phelps Dodge has expanded its line of products for the air conditioning and refrigeration industry to include a wide selection of wrot solder-type fittings. In keeping with modern specifications, both fittings and tube can now be obtained from Phelps Dodge—a single dependable source of supply.

PD wrot fittings are available in sizes ranging from ⅛-inch to six inches. All fittings are protectively packaged to assure factory-clean condition.

Initial warehouse stocks have been distributed to five key centers, Boston, Chicago, Los Angeles, Houston and Tampa, Fla., for fast, convenient service. Order through your Phelps Dodge wholesaler.

A copy of the new PD fittings catalogue is ready for you. Use the coupon below.

Phelps Dodge Copper Products Corporation, Dept. F-10, 300 Park Avenue, New York 22, N. Y.

Please send me your new fittings catalogue.

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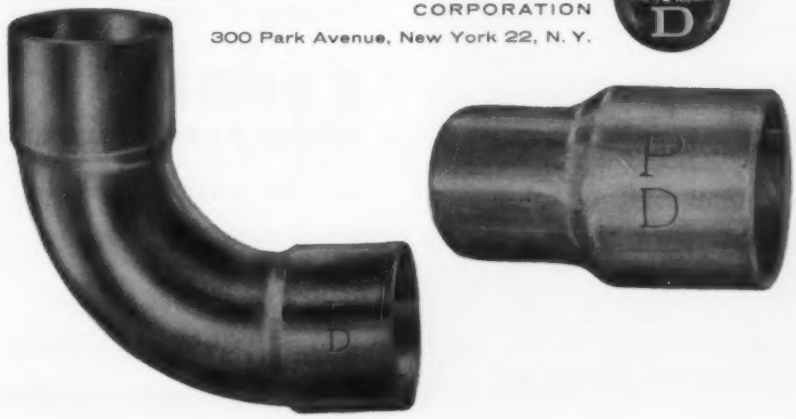
CITY_____ STATE_____

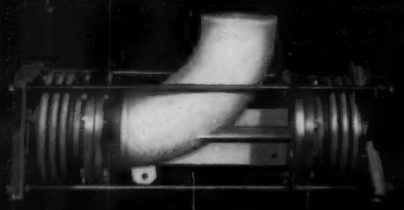
Quality tube and fittings sold the quality way—through authorized refrigeration wholesalers!

PHELPS DODGE COPPER PRODUCTS CORPORATION

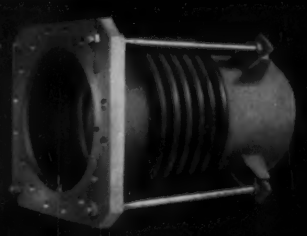
300 Park Avenue, New York 22, N. Y.



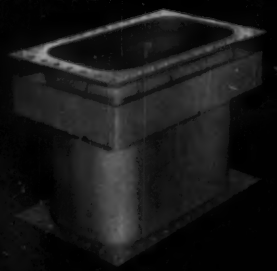
This pair of universal expansion joints is installed in the vapor piping of a gaseous diffusion plant. The lines carry Freon 114 at pressures up to 500 psig and temperatures ranging from −20°F to 300°F. Joints accommodate 3" lateral movement under these extremely harsh service conditions.



A 12" pressure balanced elbow assembly specially engineered by Badger for use in LOX storage and transfer facilities at an Air Force Missile Base. The unit is designed to operate at temperatures from −297°F to 250°F — a thermal shock range of nearly 550°! Operating pressures vary from 0 to 150 psig. Joint movement: 0.8" axial, 0.15" lateral.



One of eight specially engineered Badger Expansion Joints at a power plant for a gas recovery unit in Texas. Installation is on a cooling water piping of the surface condensers where service conditions require operation at 55 psig at a temperature of 107°F. The joints are designed to absorb ½" lateral movement in combination with ¼" axial movement.



This 24" x 44½" I.D. rectangular expansion joint, connects the turbine and condenser at a steam power plant. Each of the units is designed to operate at a pressure ranging from full vacuum to 1 psig at a temperature of 360°F. The joint handles ⅜" axial compression and a plus or minus ⅛" lateral movement.

TOUGH JOINTS

— BADGER SPECIALTY

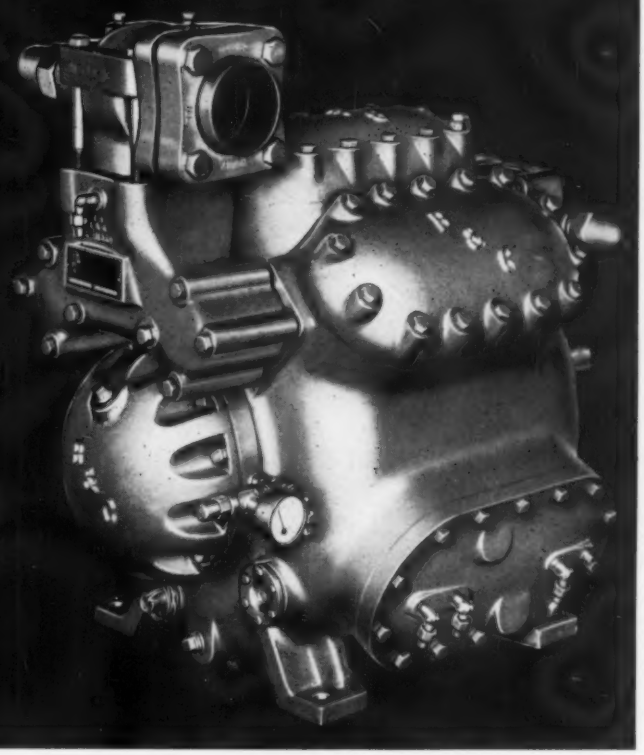
Anyone with the necessary manufacturing facilities can fabricate expansion joints. But it takes an *experienced* manufacturer to analyze tough piping problems properly and then provide the correct expansion joints to solve them. Badger, with more than 55 years in the field, has had more experience with a wider variety of special design problems than any other expansion joint manufacturer. Put this store of skill and knowledge to work for you — get the most effective and economical solution to your expansion joint problem. Call or write for complete information about Badger S-R Expansion Joints and our "on-the-spot" engineering service.

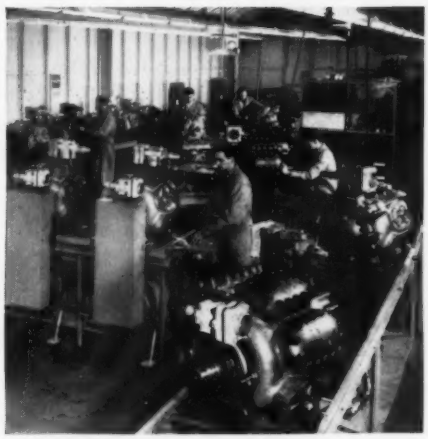
BADGER
MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE 41, MASSACHUSETTS

Representatives in Principal Cities

no motor burn-out system contamination with this "open" compressor





B&G Compressors are built in atmosphere-controlled shops under rigidly checked manufacturing methods. Available in capacities from 7½ to 150 tons.

B&G builds "open" compressors because in actual operation they offer many exclusive and outstanding advantages. Where an open compressor is used, elaborate precautions to evacuate and dehydrate a refrigeration system are not necessary. It can be serviced by the average contractor —no special tools or equipment needed.

Motor burn-out in a closed system leads to system contamination—with an exceedingly involved procedure necessary to clean up the system. This means considerable down-time and possible large loss of revenue or spoilage.

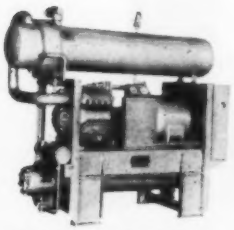
Quieter operation with less vibration are distinguishing features of the B&G Compressor. It is engineered to establish higher standards of performance...ruggedly built for longer life. It has fewer parts, hence presents fewer maintenance problems. All units have *one* bore—a few interchangeable parts will service them all.

Send for literature

BELL & GOSSETT
COMPANY
Dept. RGU-5 Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

A FULL LINE OF REFRIGERATION AND AIR CONDITIONING "PACKAGES" AND COMPONENTS



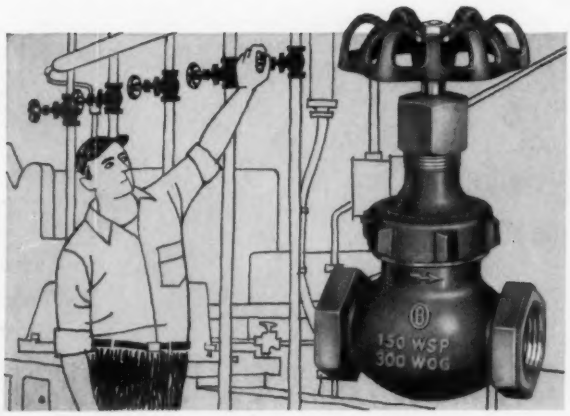
B&G Package Liquid Cooler

B&G Evaporators

B&G Centrifugal Pumps

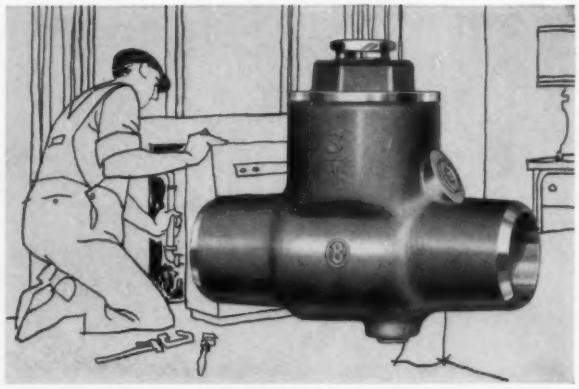
B&G Condensers

O-B Valves
maintain positive control...



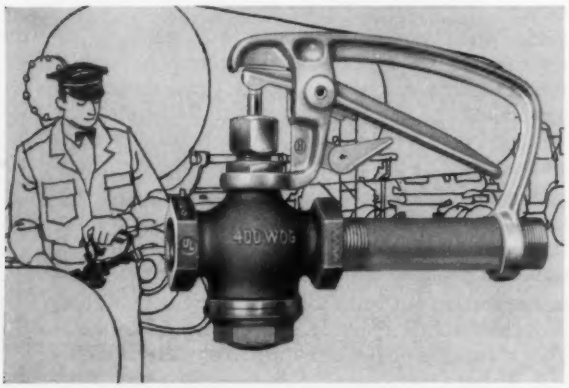
...in processing lines

Plants piping steam, water, gas, air and oil to production machinery find O-B valves hold up under severest demands. They're made for them. O-B bronze valves (like No. 1201 globe pictured) combine fine casting, precise machining and sound engineering to maintain positive flow control.



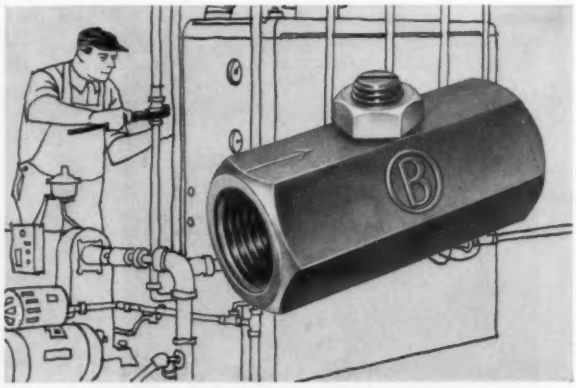
...in heating-cooling systems

Accurate heating, air conditioning and balancing of year 'round combination systems are assured by O-B "Equa-temp" valves—used also for radiant heating. A quarter turn of stem closes valve, simplifies draining without need for refilling system. Special design discourages tampering.



...in LP-gas dispensing trucks

Its exclusive construction features make this UL-listed dispensing valve ideal for transferring LP-gas from tank to tank. Body is extra heavy bronze that withstands rough handling. A stainless steel spring effects tight closure and a special latch holds valve open until it's released.



...in oil furnace feed lines

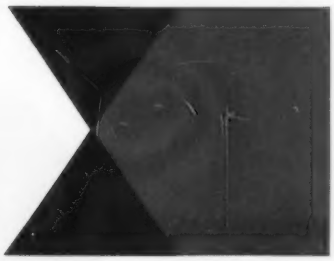
Reliable operation of oil burning furnaces is aided by this O-B bar stock valve with needle point that maintains precise regulation of fuel. Special copper base bronze stem and disc offer excellent corrosion resistance, making this valve ideal for water and gas service as well.

You profit most when you standardize on the O-B bronze valve line. You find the consistent quality you want—the efficient operation you rely on—and the freedom of choice you need—in valves from ⅛" to 3" sizes. Write for latest catalog information.

OHIO BRASS COMPANY • Mansfield, Ohio

Ask your distributor for the valve in the orange-and-black box

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

Negative Pressure Particular Problem During Pick-up, Cool-Down Periods

I HAVE READ the article *Negative Pressure in an Air Conditioned Building* by Joseph H. Jerrell in the July issue with a great deal of interest.

This article is extremely enlightening in describing the problem, and the diagnosis procedures are very good.

This same type of problem is encountered all too frequently in other structures, such as schools using mechanical ventilation. In this case, two conditions can arise: one is due to an oversized exhaust system with the same general problems as outlined by Mr. Jerrell, but the second is the operation of an exhaust system during the period of time that the cooling or heating equipment is endeavoring to heat up or cool down the building prior to occupancy.

Many owner complaints of excessive warm-up or cool-down periods can be solved simply by making certain that the exhaust system does not go into operation until the building temperature conditions are satisfied and the equipment begins to handle outdoor air.

L. R. FULLER
Manager
Unit Ventilator Sales Department
The Trane Co.

Suggests Direct Machine Exhaust To Reduce Plant Cooling Load

THE ARTICLE *Bottle Washing Plants Can be Air Conditioned*, by John Shaw in the July issue is of interest, although air conditioning of bottle washing rooms is a specialized field quite different from the type of air conditioning problems with which we are most familiar. I must admit that I am not fully acquainted with the make-up, and heat generation problems involving bottle washing machinery.

I assume, however, that the situation is similar to that of certain kitchen and sterilizing equipment, particularly that used in hospitals, with which we have had considerable experience. On such installations, it is desirable to provide sufficient exhaust directly from the heat-producing equipment or from the immediate vicinity of the equipment to prevent practically all of the equipment latent load and as much of the equipment sensible load as possible from escaping into the occupied space.

The sensible cooling load required is then equal to the solar, transmission, occupancy, lighting, outdoor make-up air, and equipment heat losses which escape into the occupied space.

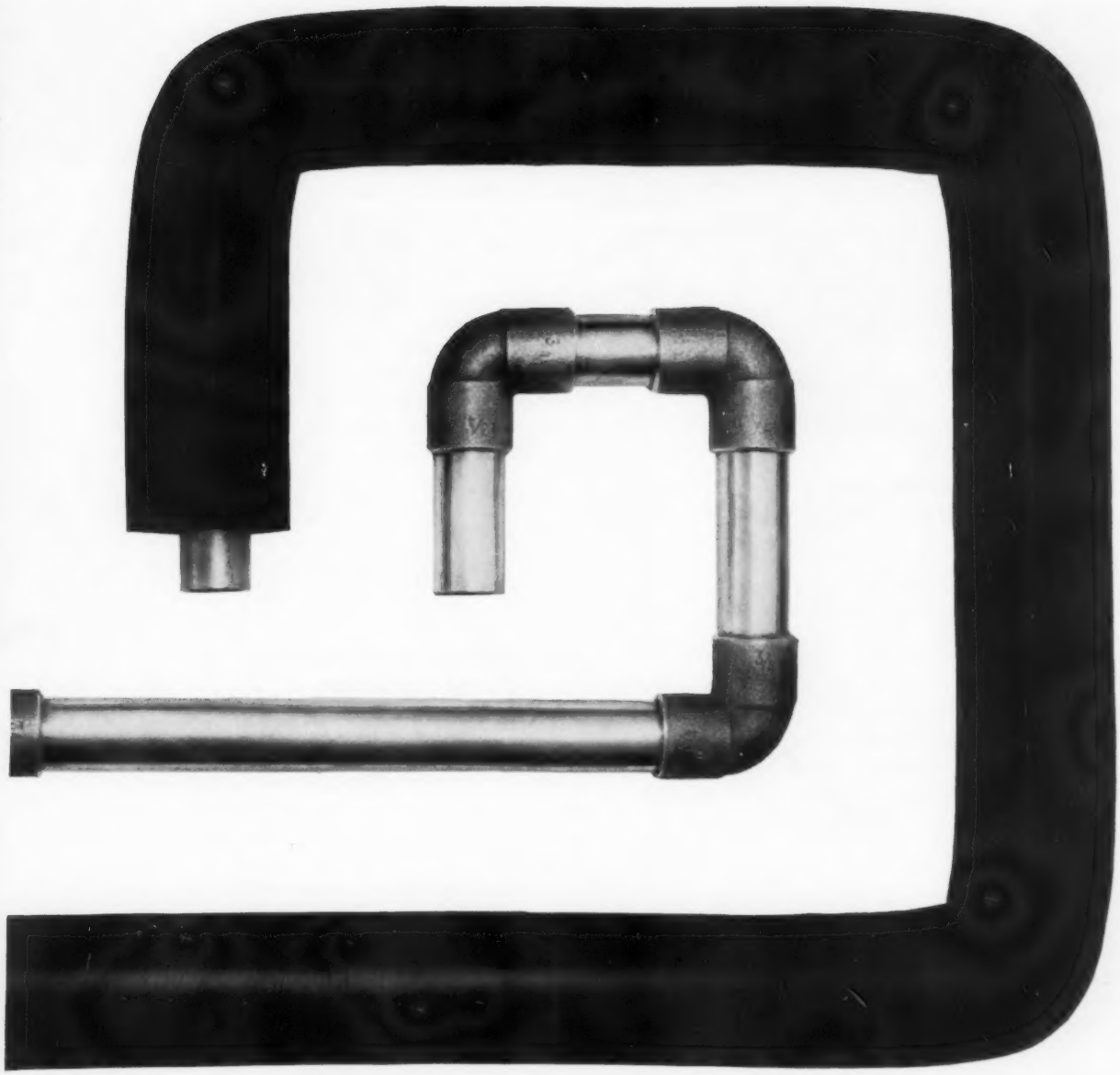
The latent cooling load will be equal to that introduced by the make-up air, occupants, and any not captured by the equipment exhaust system.

This method requires the introduction of outdoor air equivalent to the volume of air exhausted at the equipment if optimum conditions are to be maintained in the occupied space. This system has the advantage over a recirculated air system of permitting the use of outdoor air for cooling, in lieu of mechanical refrigeration, whenever the outdoor temperature is favorable.

This can result in considerable savings in operating costs and prolonged life of the refrigeration equipment. These savings can often justify a greater initial expenditure for filtering and cooling equipment that may be necessary. This would be parti-

Continued on page 90

J-M Aerotube...a flexible, anti-sweat insulation designed for quick installation on bent tubing!



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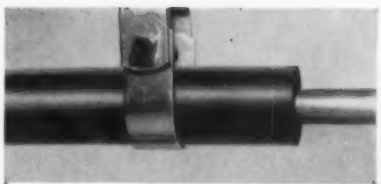

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Continued

cularly true in a case where the amount of exhaust does not exceed the minimum ventilation rate.

If such an exhaust system could be installed in a bottle washing room it would, as mentioned previously, eliminate most of the bottle washing sensible load as well as the latent load from the cooling load required. This would then reduce the total cooling load by approximately the 2 tons required to dissipate the sensible heat from the bottle washer unit.

OSCAR S. SAMUELSON
Mechanical Engineer
Ellerbe and Co.
Architects, Engineers & Planners

Even Good Heat Recovery Won't Correct Basic Faults

THE ARTICLE entitled *Heat Recovery Methods Can Produce Huge Savings*, in the August issue, which describes some of the methods discussed at the Industrial Heat Recovery Forum held at the ASHRAE meeting in Denver, was very interesting. There is no question that great savings could be accomplished if industrial engineers would set their minds to it.

A meeting devoted entirely to the subject was held in England in May and over 20 papers were presented. Some described how it was being done while others developed the potential that was available. Undoubtedly the problem of fuels is greater in England than in the United States. However, it shows the direction which must be taken.

Throughout industry there are many examples of methods that have been used to reduce either the heating or cooling load within an industrial building. It is questionable if there is any industrial plant today that could not go further than they have.

From the article it appears that the basic problems have still not been thoroughly covered as it is mentioned that methods of removing the air from the floor and discharging it toward the ceiling areas help bring the heated air down to the occupied space. When conditions are found to which this type of approach would be of help, it is usually safe to assume that the heating system itself could be greatly improved. It would seem more logical to study the entire plant and to make changes necessary to more efficiently and effectively use the heating and make-up air equipment to provide desirable conditions in the occupied space. Such changes have reduced the overall cost of heating many thousands of dollars.

Quite a few plants are overheated because of improper installation of equipment and the controls that regulate the temperature of the discharge air. In spite of the chapters that have appeared in the ASHRAE GUIDE for years discussing the physiological response of man to his environment, our heating and cooling systems are designed as though the engineer were only interested in the bare building and disregarded the effects of production machinery and the environment most desirable for workers.

I have no quarrel with the suggestions made in the Summary. However, I do not believe that most of them have been made with the idea of eliminating the problems but rather of serving as a crutch so industry can hobble along with the misapplied equipment they already possess. There is no one group of individuals responsible for these faults; it is a composite of inadequacies chargeable to the manufacturer of basic equipment, the design engineer, the contractors in charge of the installation, and of course it must include in many cases both architect and owner of the building.

K. E. ROBINSON
Ventilation Engineer
Industrial Hygiene Department
General Motors Corp.

Sees Heat Pump as "Comer" For Industrial Heating

THE ARTICLE, *Heat Pumps Condition Year 'Round In Large Factory-Warehouse*, by Robert G. Werden in the August issue telling of the use of heat pumps for air conditioning a factory-warehouse, is very much to the point. We are finding in many industrial applications a source of heat for winter use which is just as good as any other kind of heat and which, when backed up with the electrical heat coming from the reversing of the refrigeration machine, is frequently the most economical solution.

Mr. Werden does not mention it, but obviously on all industrial jobs a very low electric rate is secured from other sources. I mean by that, we have one customer who speaks in terms of 7 mil electricity because demand is taken care of entirely by the industrial process load.

We have recently completed an installation for an office where the lighting load is more than enough to take care of the heating, and the system has to cool in the wintertime. The heat pump is useful only at night or over week ends when the lights are turned off. Its use is justified because of the coefficient ratio, but you do get more heat per kilowatt from the heat pump than from the lights.

All of us will find many cases where the use of electrical heat in connection with heat pumps is the best solution to a winter heating problem.

LESTER T. AVERY
President
Avery Engineering Co.

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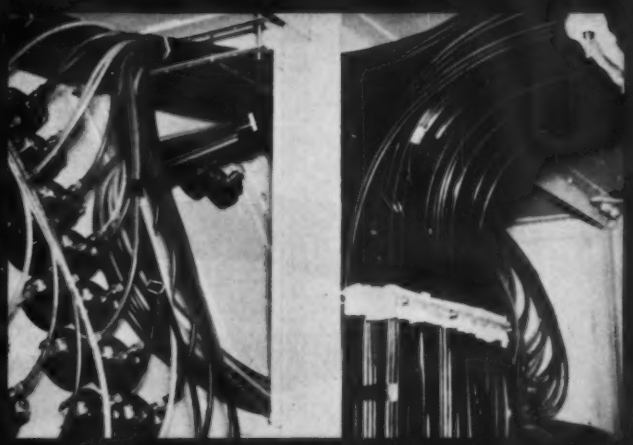

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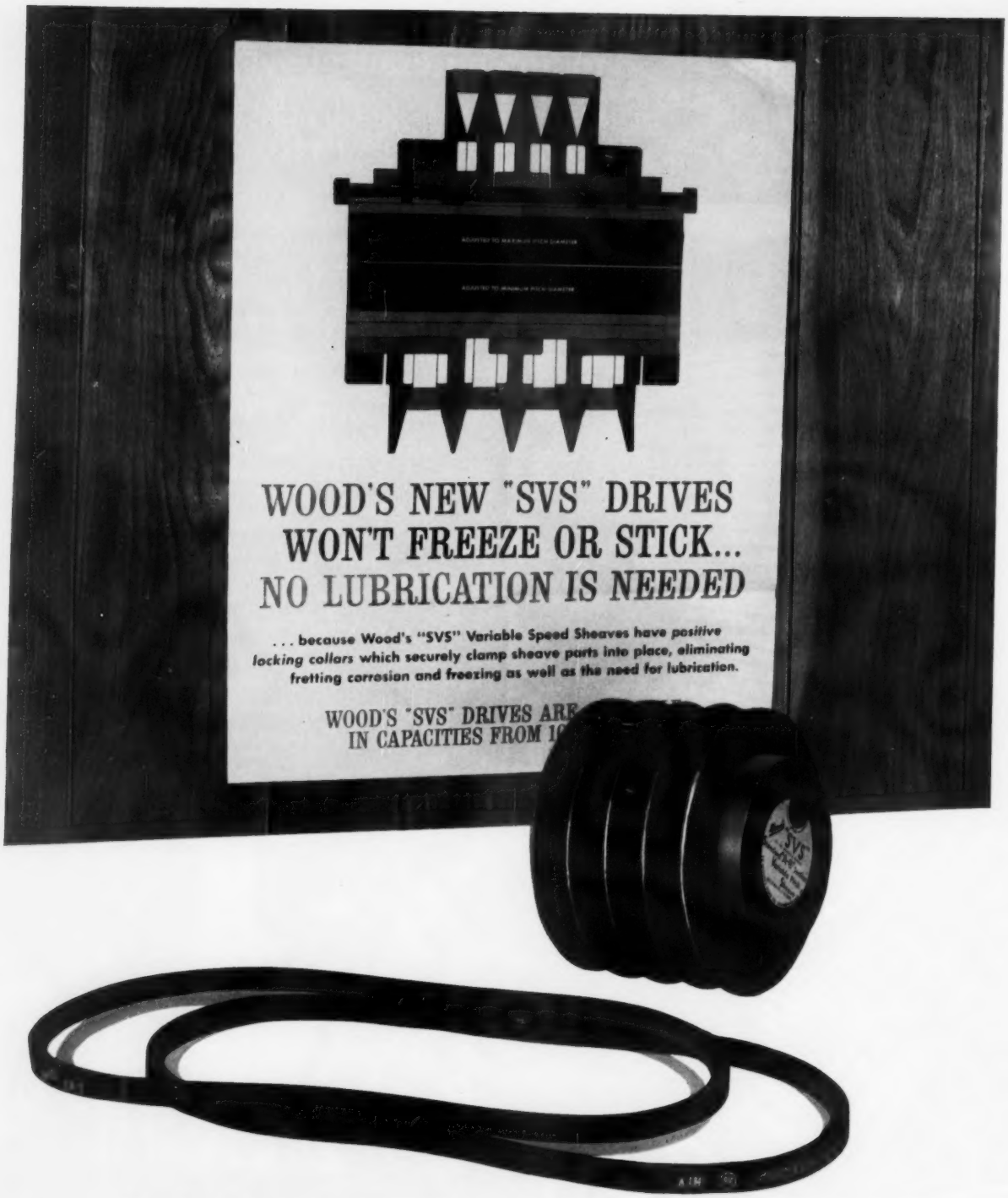
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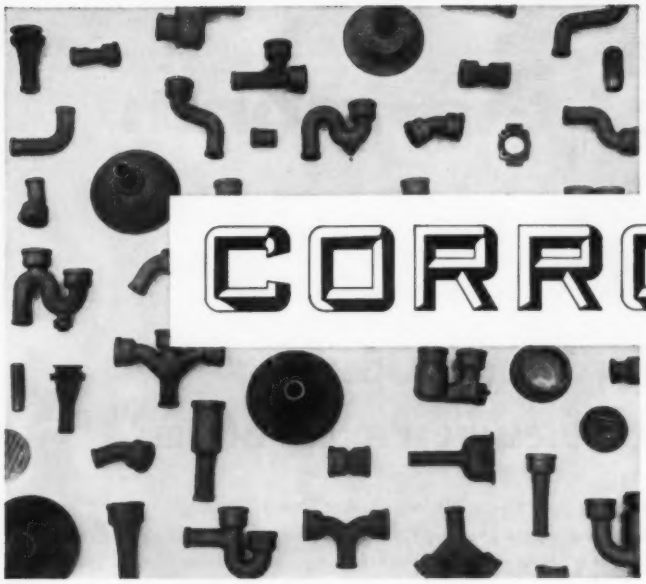

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question of the month

"How Can We Get Smooth Operation When Heating with High Pressure Process Steam?"

This question was asked previously in Heating, Piping & Air Conditioning, and is repeated here, along with two answers that have been received. Earlier answers were published in the July and August issues. Your comments for publication are invited.

"In designing a heating system to operate in conjunction with high pressure process steam, certain questions have arisen in our office.

"The boiler is to operate at 150 psig, and condensate is to be returned through a vented receiver and pumped back to the boiler. None of the steam should be contaminated.

"In designing the heating system for the building, which will include 11 unit heaters averaging 300,000 Btu per hr output, questions concerning the selection of the traps and the disposition of the flash steam likely to be encountered need clarification. We are not sure about the trap selection — whether to use a bucket trap or a float and thermostatic trap.

"Would the intermittent discharge of a bucket trap cause more flash steam to form with resultant noises in the return line?

"Would any flash steam brought back to the vented receiver be of such a quantity as to be objectionable?

"Since the ceiling height is great and there is no danger of anyone burning himself on the return main, we have considered the possibility of leaving off the return main insulation to insure condensation of any flash steam by the time it gets all the way back to the receiver.

"The equivalent length to the most distant unit heater is approximately 500 ft. Pipe sizes are based on a pressure drop of 5 psi in the supply main. Should any precaution be taken for noise due to excessive steam velocity?

"We want to be sure that any banging in the return line due to the flash steam is prevented. The return piping has been sized for a pressure drop of 0.5 psi. We have considered the possibility of installing a 3 ft section of fin pipe after every trap at each unit heater to assist in condensing any flash gas. Do others think this is necessary? Are there any precautions which should be observed in particular?'—L.L.L.

Save Flash Steam — Use It To Reduce Trap Pressure Difference

THE QUESTION relates to using steam, at pressures generated for process purposes, in unit heaters. The objective is to do so without contaminating the condensate, and without "banging" in the return piping. It is not unusual to heat with unit heaters with satisfaction under such conditions.

The results sought seem to indicate favoring traps of types which discharge more or less continually for draining the unit heaters. The traps should be of a type which readily release the non-condensable gases. Suitable types of traps are float and thermostatic traps, thermostatic traps, and inverted bucket traps. Bucket traps of some types that discharge intermittently if provided with thermostatic bypasses (so the units readily vent) would give a good account of themselves.

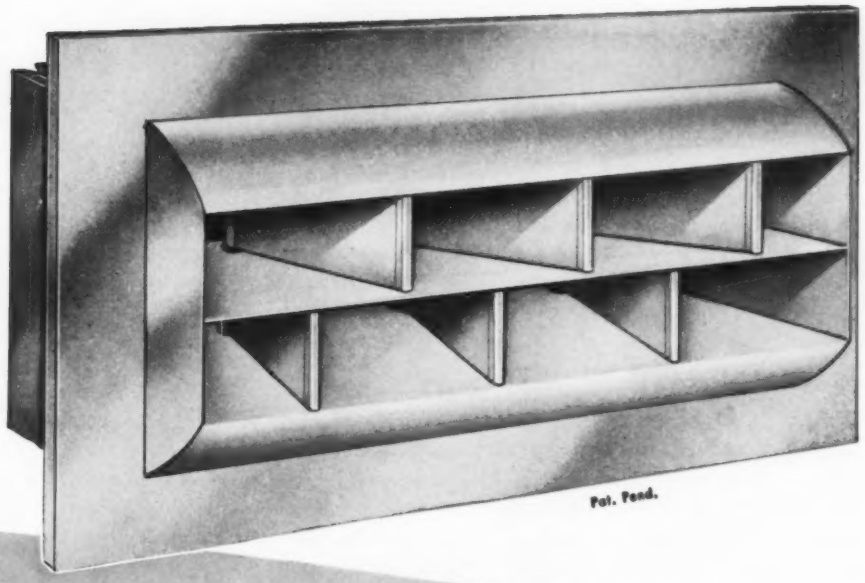
Whether the pulsations accompanying the intermittent operation might make the occupants conscious of their operation is a question. Theoretically, they would cause no more flash steam to form than other types. The quantity of flash steam forming is a function of the difference in the heat of the liquid at the initial and final conditions. That is, the difference in the heat of the liquid leaving the unit heater and that at the return pipe pressure.

Omitting the covering from the return pipe would, of course, reduce the flash steam reaching the receiver, but it is doubtful if it would keep it from reaching the receiver to the extent that the vapor leaving the vent would not be considerable. The operating conditions indicate that the revaporization would approach 50 lb per hr (theoretically).

Pipes sized to give steam velocities ranging around 6000 fpm seldom result in complaints of noise due to steam flow.

Proper operation and properly erected piping are

Continued on page 96



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The versatility of these diffusers permits distribution of air in an upward or downward projection, also left or right when desired. ROTO-JET Diffusers can be mounted either horizontally or vertically.

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When vanes are set at angles diverging from the centerline, the degree of spread may be controlled.

MODULATED DIFFUSION — The split vanes design provides an additional feature only employed in ROTO-JET DIFFUSERS. When the top row of vanes are adjusted to the left or right and the bottom vanes are in opposite directions, they produce diverging and counter-flowing jet air streams which create a high degree of turbulence, instantaneously mixing the primary and room air and resulting in rapid temperature equalization. The length of blow may be extended or shortened according to the amount of counter-flow resulting from vane settings.

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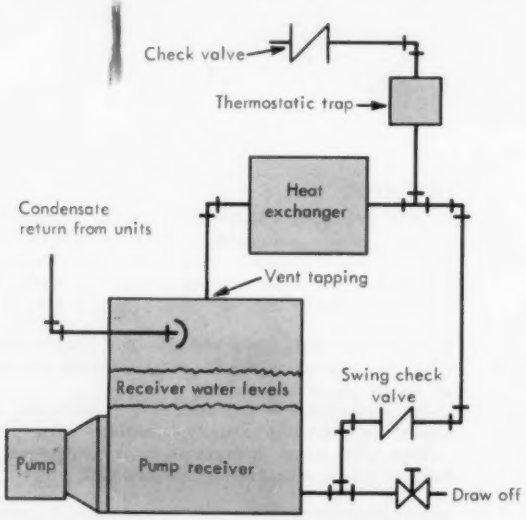
question of the month

Continued

most important in preventing hammer in return piping. Proper grading, provision for expansion, and adequate support will keep the piping free from sags and pockets which might contribute to defeating the operation sought.

Flash Can Be Reclaimed

The installation of a short section of finned pipe at the outlet of each trap would reduce the flash steam returning to the receiver, but the amount to be vented would in all probability be considerable, although it would not by any means be such an amount as the theory indicates. It would, though, be sufficient to make it desirable to reclaim it. For this purpose a desirable arrangement would be one which utilizes flash to reduce the pressure difference across the traps, after the system is up to pressure. This could be accomplished by connecting the vent to the pump receiver in the manner shown by the sketch below.



There are several advantages to be gained from such an arrangement; warmer condensate is returned to the boiler; the conditions are favorable to improved pump operation handling the hotter condensate; the make-up required is less; and, unit heater effectiveness is not impaired. Since quite appreciable pressures are likely to obtain in the condensate receiver at times, they should be selected with higher pressures in view.

In systems so arranged the non-condensable gases will be rapidly vented from the system so the heat-up time is no greater than what good operating practice would demand, and adequate venting will be maintained during operation.

D. N. Crosthwait, Jr.
Engineering Consultant
Dunham-Bush, Inc.

Trap Advice; Suggestion For Condensate Cooling in Building Heater

Several questions have been raised regarding the use of high pressure process steam for building heating. Our varied experience indicates that many plants, such as steel mills, corrugating box plants, chemical plants, feed mills, etc., which require HP steam for process applications, regularly use HP steam for building heating with particularly quiet operation and complete satisfaction.

Regarding L.L.L.'s concern over the intermittent discharge of a bucket trap, many users of steam traps feel that the intermittent operation of an inverted bucket trap is a unique advantage rather than a disadvantage. This is because intermittent discharge creates small momentary pressure drops or pulsating surges of flow across the trap orifice each time the valve opens. This pressure drop is reflected back in the condensing equipment, and results in a "scrubbing" of the condensing surfaces of both condensate and non-condensable gas films.

Such scrubbing tends to bring the condensate and air to the trap where it can be discharged immediately. Therefore, with the condensing surfaces free of insulating films, the unit heater condenses at a maximum design rate.

Normally a bucket trap that is properly sized will average four to six open and close cycles per minute. The duration of the trap discharge cycle is several seconds, depending upon the condensate load.

In contrast, a float and thermostatic trap operates to give a continuous discharge, or condensate flow. Thus there are no momentary pressure turbulences created within the unit heater condenser to help bring condensate and non-condensables to the trap.

Maintenance of bucket traps on 150 psig steam systems may also be less than required for float and thermostatic traps, due to the "snap action" — full open or full close — of the former. The valve and seat of a float and thermostatic unit remains in a modulating position, and on periods of low condensate flow, the condensate velocities across the trap orifices may be very high. This tends to cause rapid wire drawing of the valve and seats when the pressure differential is above 15 psig.

The quantity of flash steam created by the discharge of either the inverted bucket or float and thermostatic trap would be theoretically identical. Flash steam produced from condensate is due to the discharge temperature of the condensate rather than to the type of trap used. Both types should discharge

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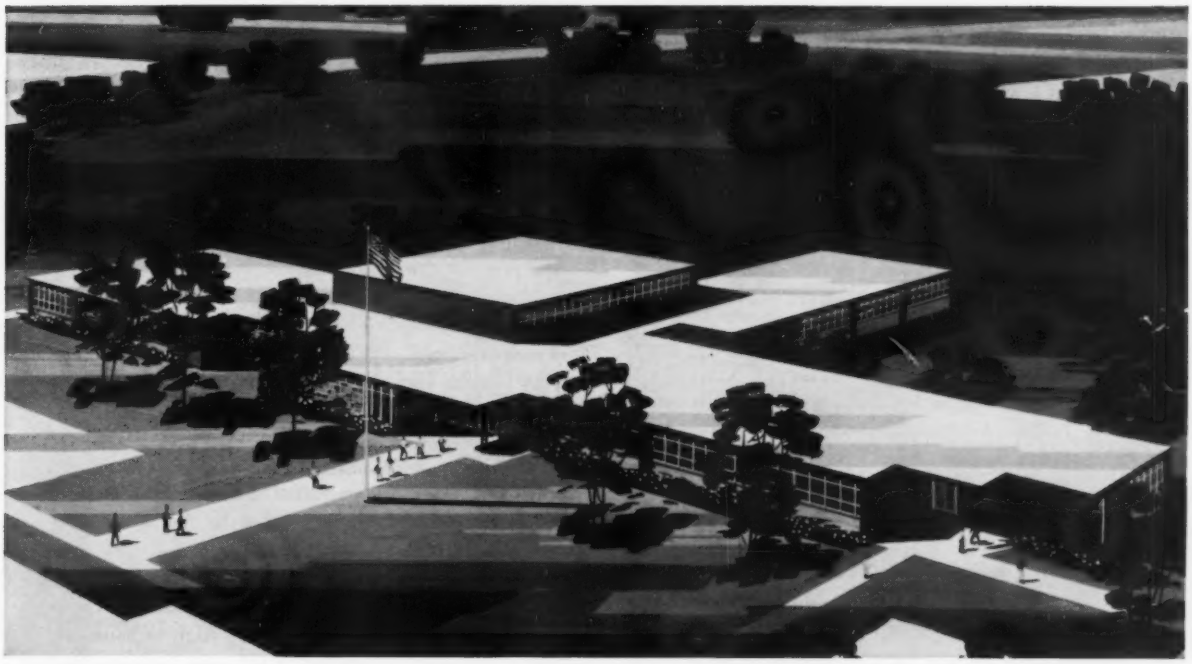

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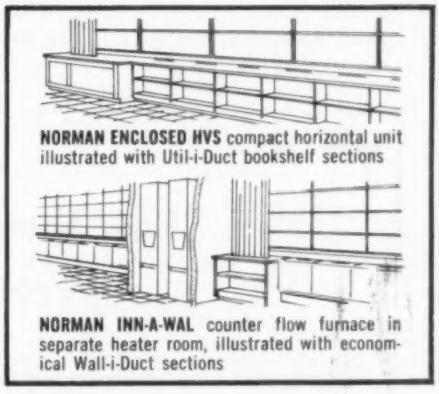
A Norman System in each room or area automatically blends fresh outdoor air with recirculated room air . . . automatically compensates for occupancy, solar heat gain and other variables . . . and automatically recirculates room air only during unoccupied periods. Air conditioning may be included or added later.

For facts and figures, write for comprehensive manuals on Norman Horizontal and Inn-A-Wal models.



NORMAN ENCLOSED HVS compact horizontal unit illustrated with Util-i-Duct bookshelf sections

NORMAN INN-A-WAL counter flow furnace in separate heater room, illustrated with economical Wall-i-Duct sections

Boulder Hill Elementary School, Oswego, Ill. **Superintendent of Schools:** T. Loyd Traughber **Architects and Engineers:** Kruegel, Healy & Moore, Joliet, Ill. **Heating & Ventilating:** Feltes Heating & Air Conditioning, Aurora, Ill.

Norman® PRODUCTS CO. 1156 Chesapeake Ave., Columbus 12, Ohio

question of the month

Continued

condensate extremely close to saturated steam temperature of 360 F on 150 psig steam. Condensate at this temperature would theoretically flash 16.3 percent of the liquid (by weight) into steam. However, this flash steam should not cause a banging noise within the condensate piping.

Any noise caused by flash steam usually arises when higher temperature condensate mixes with lower pressure and cooler condensate. An example might be in a hospital, where high pressure drip traps are sometimes discharged into low pressure return heating lines or into pumped condensate lines.

The rapid collapse of HP flash steam bubbles condensing within the LP cooler condensate lines will cause objectionable water hammer or banging noises. Consequently, in installations such as these, methods should be utilized to cool the HP condensate before it enters the LP line. However, when HP condensate is discharged directly into an HP return line, the back pressure built up within the line keeps the condensate at an elevated temperature, and therefore the flash bubbles do not collapse as rapidly and operation is quiet.

The quantity of flash steam produced in L.L.L.'s proposed installation at the vented boiler receiver may be both objectionable to operation and costly. It is estimated that with 3.3 million Btu design heating load, about 3700 lb of steam per hr will be condensed. On the basis of 16.3 percent by weight flash steam, minus the normal radiation losses of uninsulated return line piping, the flash steam lost would amount to 586,500 Btu per hr (3700 lb × 158.5 Btu per lb of condensate).

Rather than using short lengths of finned radiation on the discharge side of the unit heater traps to cool the condensate, we would suggest consideration of the use of one of the unit heaters as a condensate cooler. This will allow the use of the heat in the condensate to help heat the building. We assume that the design heat load within the building is evenly distributed so that a majority of the heaters will operate in unison. If this is so, it would be possible to pipe the condensate from 10 of the 11 heaters through the 11th heater. The result would be that this heater not only would cool the condensate below the flash point, but would offer a reduced steam load on the boiler. In addition, the boiler makeup water and water treatment chemicals required for replacement, and the flash steam formerly vented to the atmosphere would be saved.

With an estimated 5 psig pressure drop designed for the steam supply main, we estimate that line velocities would not be sufficiently high to cause objectionable noise. Likewise, a 0.5 psig pressure drop for the condensate lines is well below accepted maximum design condensate pressure drops.

The distinct advantages of HP *vs* LP steam heating are of course smaller pipes, valves, and unit heaters. However, when HP steam is the heating medium, low temperature outlet unit heaters should be considered. This will insure that the outlet temperature of the heated air from the heater is not too hot. If standard heaters are used with HP steam, usually the outlet temperature of the air is too high. Experience indicates that this results in objectionable stratification of temperature within the building.

DICK LEE
Affiliated Steam Equipment Co.

READER ASKS—

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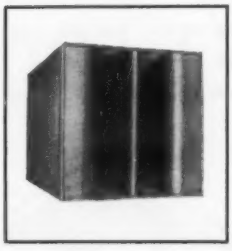

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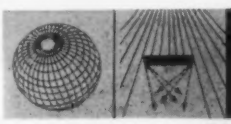

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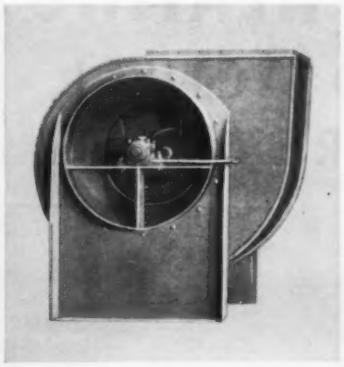

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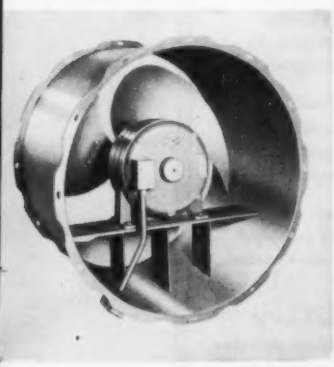

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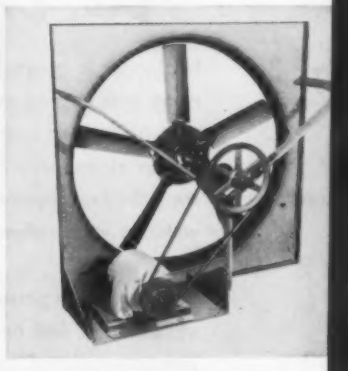

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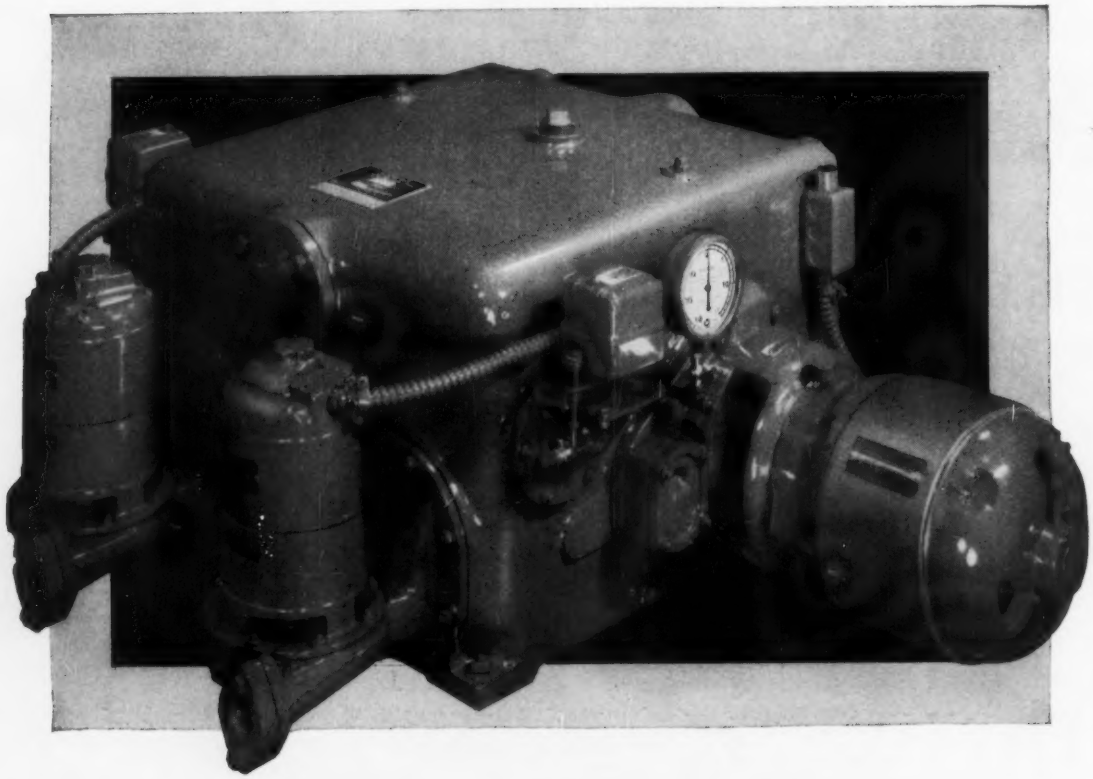

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This article on piping labor man hours has been developed as a result of an earlier article[1] written by Mr. Mark for HPAC readers on the same subject. Comments received from readers pertaining to the definitions and estimating data proposed by the author have been incorporated into the data presented here. This refined data can serve as a basis on which the engineer can develop better piping labor cost figures, and therefore better piping estimates.

Readers are again invited to contribute piping cost estimate information from their own experiences, especially as regards the degree to which the man hour estimates on installing pipe and fittings corresponds to their own methods of calculating piping costs. Address the Editors, at 6 N. Michigan Ave., Chicago 2.

Use These Tables to Estimate Man Hour Requirements For Installing Welded Piping

By E. JOHN MARK
Staff Engineer
General Engineering Dept.
The Pure Oil Co.

PIPING INSTALLATION labor costs can be developed easily and accurately if the method used is one which reflects the true basic costs of the piping job to the exclusion of "attendant" or fringe expenses. Many of the problems of estimating arise when the basic data includes items which could and should be separate expenses.

It is apparent from information available on the use of "piping labor units" that many estimators are including miscellaneous costs in their basic labor units. This is one good reason why there are large variations in the figures presented in published pipe estimating articles.

What Should Be Excluded?

The units of labor used in estimating piping costs should be set up to reflect only those basic costs incurred by the piping crew and the crew foreman. There should be no extraneous items included which vary due to design, or which can be considered as separate items of work, or as part of the general overhead normally required for a complete job. For example, the expense of large tools and equipment, general supervision other than by the piping crew foreman, and the cost of welder certification should be carried separately.

An important point — information presented in this article does not include man hours for installation of pipe supports, hangers, or stools, because of the various types of supports that could be used. Reader comments indicate that support costs often increase piping man hours per ft greatly. We recognize that this is true. However, hangers and supports are specific items of construction and can be estimated as man hours per ft of pipe, provided suitable tables are set up for the various types used. Reference (4) presents suitable basic man hours required to install various types of pipe hangers or miscellaneous supports, and this data can be used with the tabular information in this article.

How Estimating Should Proceed

As discussed in our earlier article on this subject,[1] the basic data for developing piping estimates should be the man hours required for the installation. Once this is established, labor unit prices for various components of a piping system can be developed, if desired. Often the man hours estimate can be used by the contractor as a check against actual job requirements.

Man hour requirements for a pipe fitting can be

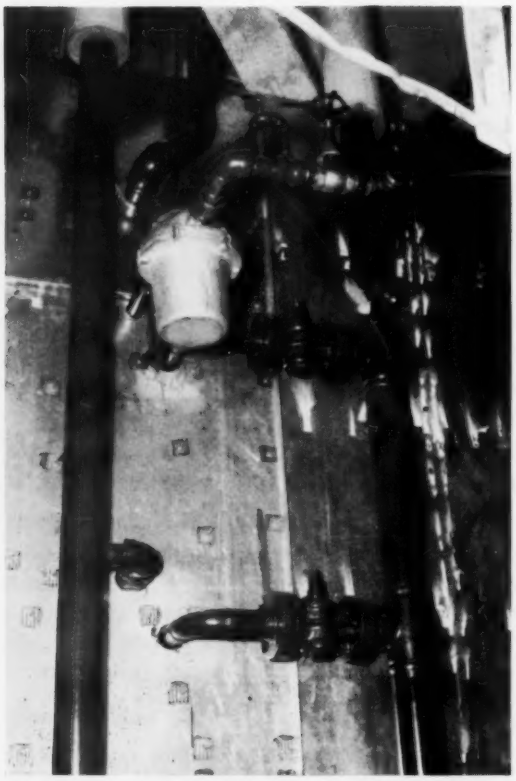
[1]Mark, E. John, *Good Piping Cost Estimates Demand Basic Understanding of Terms*, Heating, Piping & Air Conditioning, Vol. 33 No. 1, January 1961

TABLE 1 — PIPE INSTALLATION MAN HOURS per 100 ft of pipe installed overhead on supports 10 to 20 ft above grade. Pipe material: carbon steel seamless, beveled ends, various common thicknesses

Pipe size,	Pipe thickness				
in.	Sch. 10	Sch. 20	Sch. 30	Sch. 40	Sch. 80
2				14.05	15.95
3				18.35	24.30
4				21.50	26.20
6				31.90	40.30
8			33.80	40.20	56.30
10			45.00	52.50	
12			63.80	75.70	
14	57.00	71.00	87.00		
16	63.60	79.95	97.20		
18	72.00	90.00	115.00		
24	119.00	139.50	230.00		

TABLE 2 — ADJUSTMENT FACTORS shown here can be used to convert pipe labor units set up on basis of a 10 to 20 ft above grade elevation to either "on grade" or "below grade" basis. For installations at the latter two levels, multiply man hours obtained from Table 1 by these factors

Pipe size, in.	Overhead pipe (10 to 20 ft above grade)	Above grade pipe (on supports from grade to 4 ft above grade)	Underground pipe (below grade, no deeper than 4 ft)
1 to 4	1.0	0.8	0.9
6 to 10	1.0	0.7	0.8
12 to 24	1.0	0.6	0.7



NUMBER OF WELDS to accommodate fittings for flanges, valves, etc., must be included in cost estimates, as indicated in Tables 3 and 4

defined as the *time needed to receive, store, distribute for use, fitup, weld (or thread for screwed fittings), and erect.*

For a pipe section, man hour requirements are based on *handling and erection, with additional man hours for each weld or threaded connection.*

How Data Evolved

In the earlier article, two basic piping systems were illustrated, along with estimates of the man hours required to install those systems, obtained from several sources. The tables in the present article cover man hour requirements for the installation of welded pipe systems, for fittings, flanges, and valves. These data are typical for process or power piping construction, and include variations due to pipe thickness, physical conditions, and some definition of the effect of various labor efficiencies.

The accuracy of these estimates has been validated from written comments received subsequent to the presentation of the first article. Replies to the original estimates included either comparative man hour evaluations or data which substantiated the published figures.

Tables Show Requirements

Table 1 estimates the man hours required for the installation of pipe, including the time for receiving,

TABLE 3 — WELDED FITTINGS man hours, for various thicknesses of fittings

Pipe size, in.	Welding ell		Welding tee		Reducers	
	std. wt.	ex. strong	std. wt.	ex. strong	std. wt.	ex. strong
2	2.81	3.74	3.74	5.15	—	—
2 x 1½	—	—	—	—	2.62	3.41
3	3.74	5.15	5.14	7.47	—	—
3 x 2	—	—	—	—	3.37	4.54
4	4.68	6.85	6.46	9.81	—	—
4 x 3	—	—	—	—	4.30	6.12
6	7.02	11.95	9.58	16.85	—	—
6 x 4	—	—	—	—	6.22	9.72
8	9.35	15.90	12.90	22.40	—	—
8 x 6	—	—	—	—	8.41	14.15
10	11.92	19.65	16.40	28.10	—	—
10 x 8	—	—	—	—	11.05	18.20
12	14.05	23.90	19.20	33.70	—	—
12 x 10	—	—	—	—	13.40	24.30
14	16.40	26.20	22.50	38.40	—	—
14 x 12	—	—	—	—	17.80	—
16	19.28	31.80	26.20	44.90	—	—
16 x 14	—	—	—	—	21.10	—
18	22.40	35.60	29.90	50.50	—	—
18 x 16	—	—	—	—	25.20	—
24	30.00	47.80	38.30	67.30	—	—
24 x 20	—	—	—	—	32.80	—

MAN HOURS for welding will depend on types of fittings, pipe sizes, and the number of "extra" saddle or buttwelds required, as shown in Tables 3, 4, and 6

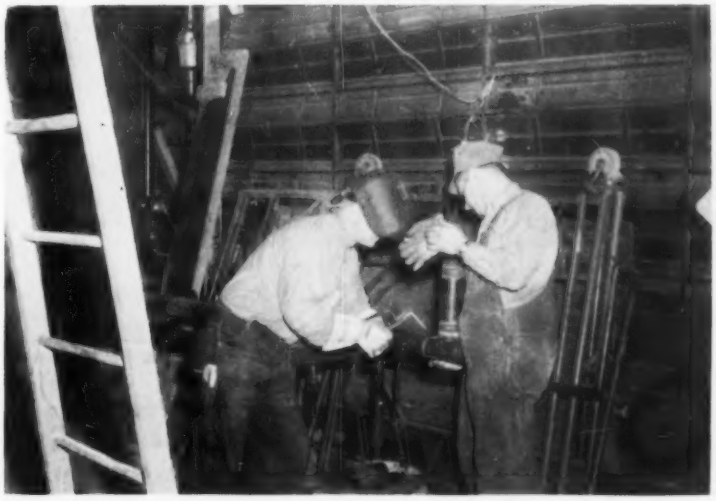


TABLE 4 — MAN HOURS FOR INSTALLATION OF FLANGES of various sizes, pressures and bores

Pipe size, in.	Weld neck flanges			
	150 lb std. bore	150 lb X-strong bore	300 lb std. bore	300 lb X-strong bore
2	2.12	2.58	2.43	2.95
3	2.81	3.47	3.23	3.99
4	3.29	4.40	3.78	5.04
6	4.68	7.25	5.38	8.33
8	6.62	9.58	7.27	10.85
10	7.97	—	10.20	—
12	10.40	—	10.80	—
14	11.25	—	12.95	—
16	12.60	—	14.55	—
18	15.95	—	18.40	—
24	18.70	—	21.50	—

TABLE 5 — MAN HOURS FOR INSTALLING FLANGED VALVES of various sizes and pressures

Pipe size, in.	Flanged valves	
	150 lb	300 lb
2	1.87	1.98
3	2.81	3.15
4	3.74	4.28
6	4.68	5.40
8	5.62	6.52
10	7.47	8.55
12	9.37	10.80
14	11.25	
16	13.05	
18	14.95	
24	20.70	

storing, handling, fitup, welding, and erection. These data assume that the pipe is being installed 10 to 20 ft above grade. If the installation height varies from that level, conversion factors to "relocate" the system either above or below grade can be extracted from Table 2.

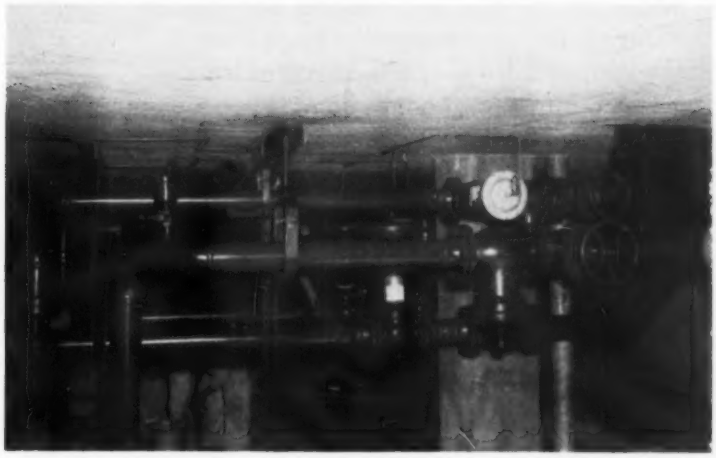
It should be remembered that the actual physical location of the piping installation is an extremely important factor in estimating cost. For example, if pipe is to be erected 50 to 75 ft above grade, special rigging or scaffolding would be needed, and the cost of that preparation is properly included in the piping estimate. Further, the time required to install and handle the pipe would be greater. In such a case, the man hours required might be increased by as much as 25 to 50 percent. Experience must dictate how radical an increase in estimated man hours will be needed to compensate for extreme conditions like this.

Fittings, Flanges, and Valves

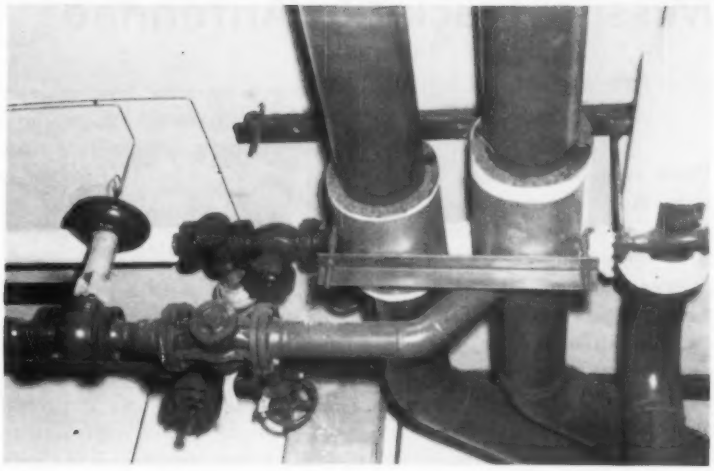
Tables 3 and 4 present man hour requirements for the installation of welded fittings and flanges, including the time needed for receiving, storing, handling, fitup, welding, and erection, for various fitting thicknesses. For flanges, an allowance has been included for bolting. Thus, the time estimate shown for welding the flanged fitting into the structure includes sufficient time to bolt the flange to the next section or fitting. As a result, the time allowances for installing valves, as shown in Table 5, includes only the receiving, storing, handling, and erection into position, and excludes bolt up.

TABLE 6 — MAN HOURS FOR BUTTWELDS AND SADDLEWELDS of various pipe thicknesses. Saddlewelds are for welds saddled into pipe of one pipe diameter larger or more

Pipe size, in.		Buttwelds (BW) And Saddle Welds (SW)				
		Sch. 10	Sch. 20	Sch. 30	Sch. 40	Sch. 80
2	BW	—	—	—	1.52	1.95
	SW	—	—	—	2.25	3.00
3	BW	—	—	—	2.17	2.82
	SW	—	—	—	3.20	4.20
4	BW	—	—	—	2.60	3.70
	SW	—	—	—	3.90	4.05
6	BW	—	—	—	3.60	5.00
	SW	—	—	—	5.40	7.50
8	BW	—	—	—	4.95	7.00
	SW	—	—	—	7.50	10.50
10	BW	—	—	5.30	6.00	8.00
	SW	—	—	7.95	9.00	12.00
12	BW	—	5.50	6.50		
	SW	—	8.25	9.75		
14	BW	5.70	6.50	7.50		
	SW	8.55	9.75	11.25		
16	BW	6.50	7.50	8.40		
	SW	9.75	11.25	12.60		
18	BW	7.00	8.25	11.00		
	SW	10.50	12.40	16.50		
24	BW	8.00	10.00	15.00		
	SW	12.00	15.00	22.50		



PIPING LOCATION, on, above, or below grade, and "room to work" will affect cost of installing system



HANGERS AND SUPPORTS can be estimated relative to man hours per ft of pipe if suitable tables are established for that purpose

The basic piping labor estimates of Table 1 assume one weld per 40 ft section of pipe. If additional welds are required, or if the pipe comes in longer lengths, the labor units for pipes can be adjusted for more or less labor units per ft. Additional information on the man hours required for "extra" buttwelds or saddlewelds is presented in Table 6.

Short-Section Welding Is Included

If the pipe is cut into shorter sections (than the 40 ft base length) to accommodate fittings, no additional buttweld time need be added, since the allowance for the installation of the fittings includes the time needed for all necessary welding.

A range of ± 10 percent around the values taken from these tables will still be a reasonable estimate of man hours when estimating a job for a specific location and condition. For highly industrialized locations, very close quarters, or extremely hot working conditions, man hour requirements might be as much as 10 percent more than those shown in the tables. In rural areas, or small cities where manpower is available and works under less turmoil, a saving of 10 percent can be anticipated over the man hours shown. The data presented here can be checked against the reader's own experience to arrive at a satisfactory efficiency factor for his own situation. ⫩

References

1) Company A — Etimating data, unpublished

2) Company B — Estimating data, unpublished

3) Clark, W. G., *Accurate Way to Esitmate Pipe Costs*, included in "Cost Engineering in the Process Industry," by C. Chilton. McGraw-Hill Book Co., Inc., 1960

4) Herkimer, H., *Cost Manual for Piping and Mechanical Construction*, Tudor Publishing Co., Inc. 1958

5) Roberts, O. R., *How to Estimate Piping Labor*, Petroleum Refiner; March 1960

6) Comments and data received relative to *Good Piping Cost Estimates Demand Basic Understanding of Terms*, Heating, Piping & Air Conditioning, January 1961

More on HPAC engineering contributions to the space age — huge concrete supports for Cape Canaveral trajectory control antennae have to be "absolutely" stationary for proper fixes. Precisely controlled air conditioning and extensive insulation prevent movement due to temperature variation effect on the concrete.

Air Conditioning Stabilizes Missile-Tracking Antennae

By LESTER RIES
Consulting Engineer

PRIOR to the missile age, it used to be that a surveyor could drive a stake in the ground, hammer a nail where the cross hairs and chained distance demanded, and figure a "fixed point" had been established. Not so for the engineers of Convair-Astronautics Department of Ground Measurement and Trajectory Control.

Missile trajectory control on the Atlantic Missile Range at Cape Canaveral depends upon a cluster of fixed points. Basically, three of these points form a right angle with legs of 50 and 500 meters. The angle is exact to ± 1 second of arc. Several intermediate points subject to the same accuracy, and located in a plane with the three basic locations, complete the cluster.

Points Spot Antennae

Each fixed point is the location for a tracking antenna. To support these devices, a heavily reinforced concrete structure was built for each installation. Four 20 by 20 in. columns extend approximately 35 ft into the ground and hold a 3 ft thick concrete pad located just below ground level. The columns extend up beyond this pad to support another 3 ft thick slab at the required elevation.

Each structure of approximately 75 tons supports an antenna of a few hundred lb. The whole structure is enclosed with sheet metal.

Discover Excess Movement

Maximum tolerable movement for the antenna "fixed point" was calculated to be 0.004 in. But after the preliminary installation work on the structure, this point was found to move vertically and horizontally by as much as 1/32 in.

Several causes were considered as possibly responsible for the excess movement. It was thought that the proximity of the ocean might be an aggravating factor. Among others, the following phenomena were investigated as direct causes:

1) Land mass tilting, ground settlement, and subterranean gas pockets.

2) Sonic shocks from missile flights.

3) Tidal effects upon the ground.

4) Curing of the concrete bases.

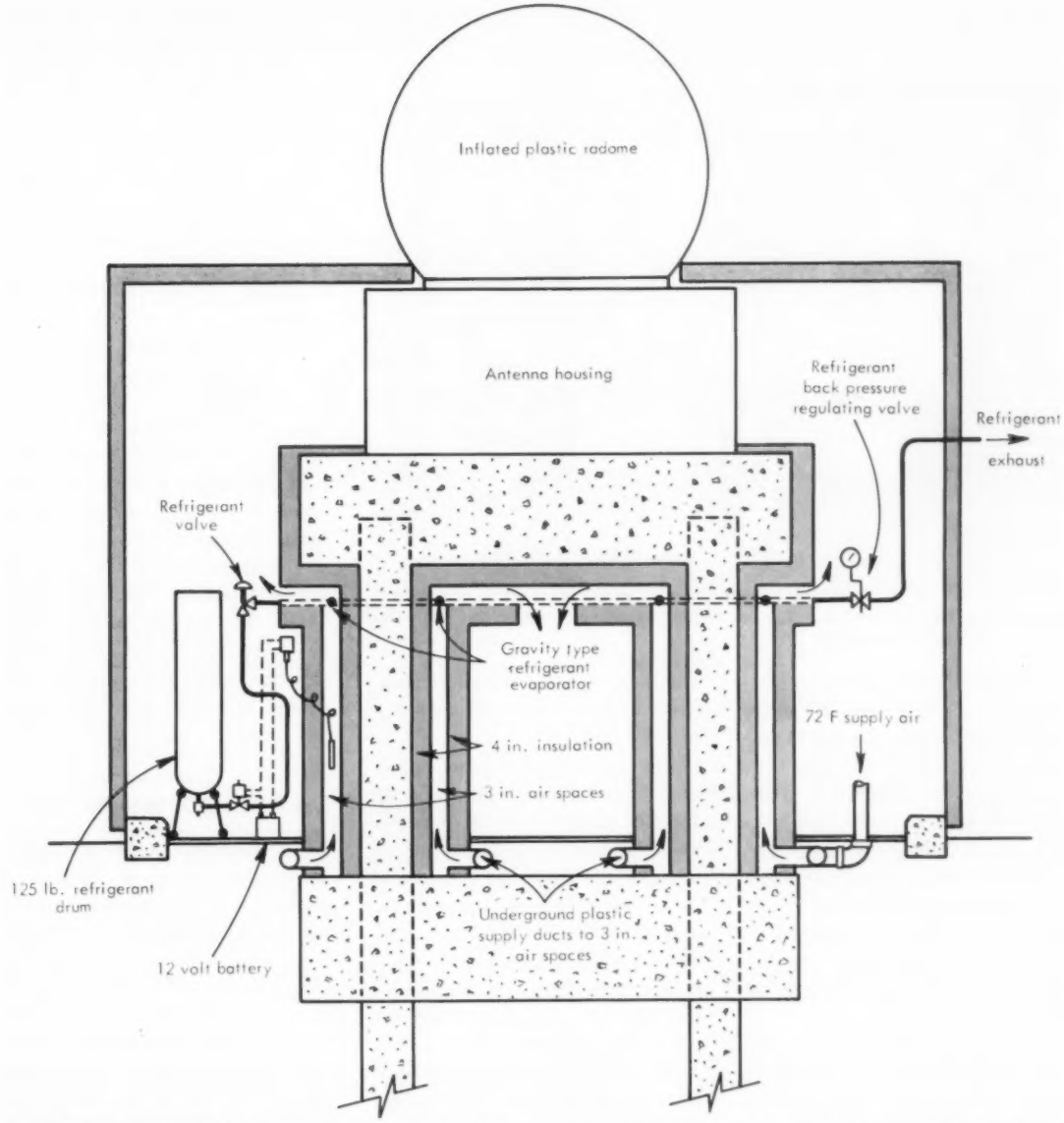
5) Ambient atmospheric variation (wind, rain, temperature).

6) Solar radiation as arrested by solid substances.

7) Dredging in a nearby channel.

Test Each Theory

As causes for the structural movement were suggested, tests were made to determine the impact of each. Measurements were taken by means of precision optics



CONCRETE STRUCTURE, which supports "fixed point" of antenna mounting, tilted, twisted, and rotated by fractions of a millimeter when air temperature changes affected concrete. Solution to problem involved combination of extensive insulation (gray areas) and stable supply of conditioned air to all structural surfaces, plus automatic standby cooling

and electronic equipment, and showed that the antenna pads were in a constant state of movement.

It was determined that heavy equipment moving in the vicinity of the pads did not produce permanent change. A large man pushing against the side of the 75 ton structure of concrete and steel could move it laterally by as much as 0.008 in. Suggested lateral bracing structures involving up to more than 600 tons of concrete probably would be ineffective in halting the movement.

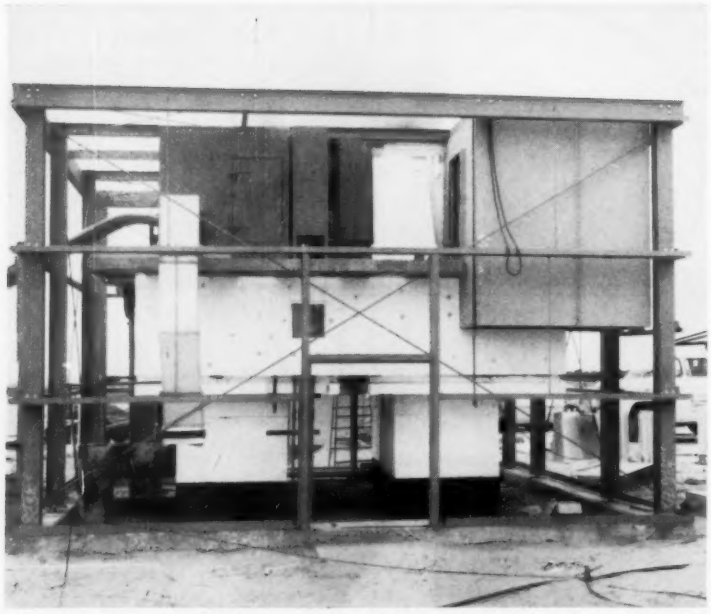
Solar shading proved ineffective in stilling the motion.

The Culprit: Temperature

Finally, elaborate testing of one structure under controlled temperature variations resulted in almost immediate response and proved that temperature changes tilted, twisted, and rotated the structure by fractions of a millimeter.

A continuous 24-hr log was kept of temperatures by means of thermocouples applied to the surfaces and within the interiors of the concrete sections. Air temperatures were manipulated to measure the structural movement in relation to recorded temperature change of the enclosure air.

Though the response of the structure to changes in air temperature was almost immediate, tests showed that at the end of a 4 hr period the interior of the 20 in. square concrete piles experienced



ANTENNA HOUSE includes air conditioning equipment box, right. Inflatable dome tops center of structure

no change in temperature. Data compiled from thermocouples buried at various depths in the concrete indicated that about 30 days would be required to affect the interior of the pile to raise or lower the temperature.

It was also noted that the measured movement of the concrete pad was greater than the product of the mean temperature change times the coefficient of expansion of the concrete.

From these observations, engineers assumed that the movement of the antenna point was partially due to the "skin effect" of the concrete during environmental temperature changes, but that temperature control of the total structure would be required.

Remedy: Even Temperature

Acceptable stabilization of the antenna point was established as follows: 2 in. of insulation was installed on the inner surface of the outer housing enclosure. Expanded polystyrene insulation, 4 in. thick, was applied directly to the surface of the concrete structure. Next, each pile support above ground level was surrounded by additional 4 in. polystyrene insulation, the two layers enclosing a 3 in. air space.

Air conditioning equipment installed in the structural enclosure supplies 72 F air to the between-layers spaces by means of plastic ducts. These ducts are directed at angles of 45 deg at two opposite corners of each column, so that the air streams are divided equally along the four vertical sides of the concrete. Air passes up between the insulation layers to a 3 in. horizontal air space, and from there disperses into the building enclosure.

Block Solar Effect

Thus, if solar heat is to affect the concrete, it must successively penetrate a 2 in. insulation layer, an air conditioned space, a 4 in. insulation partition, 3 in. conditioned air space, and finally 4 more in. of insulation.

Final temperature recordings and instrument readings on the reconstructed antenna point structure showed that the pad was stabilized within tolerable limits. Final test data confirmed that 90 percent of the concrete movement had been caused by temperature variation effect on the concrete.

After a new equilibrium temperature has been reached in the enclosure air, the concrete structure continues to move until the core of the concrete has reached equilibrium, which may take several weeks. This emphasized the necessity of stabilizing the characteristics of the conditioned air supply.

In order to provide a continuous cooling air supply in case of power failure, particularly over a three day weekend period, it was necessary to include an auxiliary system which would be as foolproof as possible. Because of its mass, the assembly would retain the temperature of the concrete within tolerable limits for about 24 hr. Mechanical failures could be corrected within that time. However, additional provision was needed to handle a possible three day outage.

Use "Bottled" Standby

An insulated drum of liquid refrigerant is piped through a solenoid valve operated by a 12 v battery. A thermostat will energize the solenoid valve whenever the temperature in the 3 in. air space exceeds 75 F. Liquid refrigerant will then feed through an expansion valve into coils of bare copper tubing located at the top of the air channel. The bare tubing acts as a gravity type evaporator to maintain approximately 75 F in the 3 in. air space.

Back pressure regulating valves at the outlet of the gravity evaporators are adjusted to maintain approximately 65 F refrigerant evaporating temperature. The refrigerant gas from the regulator is exhausted to the atmosphere.

This arrangement is a self-starting, self-supporting system that can operate continuously for three days on a 125 lb drum of refrigerant. Re-establishment of the tracking station without excessive delay is thereby insured. ≠

Mr. Stevenson has shared the results of his engineering design experience with readers of HPAC for over twenty years.

Here he begins a new series on air conditioning design practices. This first article reviews the basic factors to be considered in cooling load calculations. Subsequent pages will deal with proper zoning, and with various aspects of air distribution and control.

The Essential Factors In Cooling Load Calculations

By F. F. STEVENSON
Design Engineer

THE FOUR major factors in the design of a large-capacity air conditioning system are:

1) quality of performance,
2) first cost,
3) ease of installation, and
4) operating costs.

Though system performance may be thought of as largely a matter of engineering, it is an economic factor also, since the design objective must be to furnish the air conditioning quality which the client desires and is willing to pay for. It is in fact in this way that the last three factors come into play. We are dealing, then, with the whys and wherefores of costs.

What Affects Costs?

Cost figures will vary widely with a) geographical location, b) type and construction of the building, and c) the range of temperature, humidity, and ventilation requirements.

Geographical location will affect the design outdoor dry bulb and wet bulb temperatures and influence the solar effect.

The kind of building will affect heat transmission, sun effect, and the time lag of heat flow. For instance, the ratio of roof area to total floor area is important, especially in one story buildings. The ratio of window area to total wall area is also important, especially on west and south exposures. Another consideration is the planned thickness of insulation to be used, especially as regards roof areas. Designers will do well to consider a roof surface with high reflectivity to the sun's rays, and in many buildings, proper roof spraying will pay for itself.

Lighting Loads

Today's standards of illumination make the lighting load a major factor in air conditioning work. The designer should try to confine some of the illumination heat above the occupancy level, or to remove it from the space entirely through exhaust ventilation. It used to be that lighting load was always calculated at 100 percent of the wattage energy. Designers did not consider the fact that some of the sensible heat of lights may never get down to the occupancy level. Of course, radiant heat from lights impinges on and heats anything it "sees," but there

Lighting — how much . . .

People — how many, how often . . .

is a time lag here which tends to reduce the load.

There is no time lag, however, when the radiant heat from lighting impinges on human beings. Some 25 years ago, when knowledge of lighting loads was rather vague, a large meeting hall was air conditioned. A large number of ceiling-mounted incandescent lights were installed to produce a high ft-candle effect. Heat gain calculations made on the basis of current knowledge of that day were thought to be quite liberal, but when the space was occupied and full lighting furnished, people complained of being warm, even though the space thermostats registered 78 F. They were absorbing so much radiant heat from the lights that they were warm, notwithstanding the satisfactory ambient temperature. Fortunately, a reserve cooling capacity permitted the thermostats to be set at 75 F.

Modern fluorescent lighting develops more ft-candles with less wattage and emits less sensible heat than do incandescent units, which helps in reducing the cooling load. Sensible heat from lights heats the surrounding air very quickly, but as warm air tends to rise, it may remain stagnant near the ceiling and have little effect on the occupancy level. The air conditioning designer can use his ingenuity combined with the knowledge of the illuminating engineer to get rid of this heat through exhaust ventilation.

Occupancy and Periodic Loads

Personnel load has a considerable effect on the latent air conditioning load. However, if the occupancy of a space occurs only for limited periods, the total load may be discounted to a varying degree, and a trick or two used to produce "adequate" cooling. For instance, if a church can be pre-cooled before Sunday morning services, comfort may be maintained during the relatively short occupied period without providing enough cooling capacity to handle the building when fully occupied over long periods.

In industrial buildings, or in spaces housing electronic equipment, the electrical and motor load may be very high, and it is important to establish usage factors for such equipment — to know when and for how long it will be operating.

Another factor in the realm of "periodics" is the daily 24-hr temperature range. In Chicago during the summer season, temperatures may vary by 22 to 24 F during the course of the day, while in St. Louis, the range may remain at about 18 F for extended periods. This means that St. Louis has many hot nights, when buildings will not cool very much.

The designer should also note whether or not the building is to be used at night or on week-ends, with a view towards shutting down cooling equipment during unoccupied intervals.

In all these cases, heat transmission time lag, mentioned in the section on lighting loads, is also a factor — one to the designer's advantage.

Sun Effect on Cooling Loads

The radiant effect of the sun grows more important as glass areas in buildings become more extensive. Solar effect on solid walls is of relatively small importance, even on west exposures where radiant impingement is very high. If walls are reasonably substantial, the time lag in the flow of heat through them may run from four to six hours. In that event, sun heat on west walls does not impose a load on the cooling system until evening at least.

Average roofs, however, do not allow such a time

lag, and sun effect through roofs may become an important factor in the early afternoon. Radiant heat from the sun passes through ordinary glass instantaneously, and can soon represent a heavy load. Much has been accomplished to reduce sun effect through glass in the last few years. Special glass will bar the passage of some rays in the solar spectrum; double panes will retard radiant heat flow to some extent, and inside blinds, if the blades are made of reflective material, help to bar the sun rays (the latter, of course, also act to shut out light).

On one installation, which served a row of small executive offices along a south wall, no outside shading was provided, and in late fall with the sun effect at its peak the radiant impingement on the blind louvers at each window was so great that the blinds warmed up and became in effect radiant space heaters. The blinds were replaced by units having louvers of a more reflective material, which helped somewhat. A "perfect" but expensive answer to the problem in this case would have been a vertical flow of cool air up from the floor across the blinds to carry heat to an exhaust intake above the window.

Best "Eliminator" Is Exclusion

Designers are now agreed that the best place to trap radiant heat is outside the building. Devices for this purpose are many and varied, including overhangs, marquees, jalousies, horizontal and vertical stacks or louvers, louvered awnings, and others. The old fashioned canvas awning has been exposed as a heat revervoir rather than a heat eliminator, and is little used in modern buildings. Special window screens are helpful, but are not being used to the extent that the louvered devices are.

Again, it must be remembered that for sun and lighting heat, there is a definite time lag involved, as well as a dissipation of the heat effect. When such rays enter an air conditioned space, they impinge on walls, ceilings, carpeted floors, furniture, etc., causing these objects to heat up.

For example, as soon as the surface temperature of an interior wall is raised to a value higher than the interior components of the wall, heat starts to flow in *that* direction by conduction. Such heat is not added to the cooling load. As the wall surface temperature continues to rise, the wall starts to emit heat to the room by convection. This is an immediate cooling load, but it is obvious that a definite time period has elapsed, and also that the heat flow to the space is not as great as the original radiant effect.

We see that such loads are changed from high peaks to lower plateaus, and since the sun load is a transitory phenomenon, it would seem that a portion of the instantaneous sun loads as tabulated in source material never become a part of the cooling load. This must be carefully considered by the designer.

How Critical Is The Design?

Indoor temperature and humidity requirements can be more or less stringent in comfort installations — again depending upon what the owner is prepared to demand, and to pay for. It may not be good business to insist upon sizing a system for the ultimate design load when such a load occurs only for a few hours during the entire cooling season. It might also be impractical to design for 50 percent RH in a comfort cooling job when an RH of 55 percent would result in worthwhile savings.

It is nonetheless important, when large groups of people will congregate in a space, to accurately determine the moisture emission from the occupants, in

Usage — when, for how long . . .

Sun load — how strong . . .

order not to go awry on the true latent load of the area. Many an inexperienced engineer has been nonplussed to find that the actual load at the cooling coil in an installation is quite a bit higher than the calculated load. This always occurs when the internal sensible heat ratio is high.

In such circumstances, an average finned-tube coil, in cooling the air to the required DB temperature, will condense a greater than necessary amount of moisture from the air, making the relative humidity in the space several points lower than designed.

This additional latent load must be added to the refrigeration machine capacity requirements. Nothing much can be done about the situation, although the designer can experiment with deep and shallow coil depths, variations in air velocity, refrigerant temperatures and the like, if he wishes.

Beware of "Standard" Conditions

It may not be wise for the designer to always adhere blindly to standard conditions of indoor temperature in purely comfort installations. For instance, to try and maintain exactly 80 F DB when the outside temperature is 95 F may not be good practice in an area where it gets that hot only for a few hours during a season. This is especially true when to do so means selecting a larger capacity refrigeration unit.

As stated before, the same is true as regards holding an exact 50 percent relative humidity level. Tests have shown that at a temperature of 80 F, occupants of a space cannot tell the difference between an RH of 50 percent and one of 55 percent.

Consider Temperature Differential

Another area of choice involves the method and extent to which a differential is maintained between outdoor and indoor temperatures. Some owners prefer a gradual drop of indoor temperature in relation to a decrease in outdoor temperature. To accomplish this, space thermostats must be periodically reset, either manually or by automatic control. Since the former depends upon someone's attention, the extra expense of the sometimes elaborate automatic reset devices may be justified. When automatic reset is used, frequently it is based on an indoor temperature of 80 F when the outside value is 95 F, with a drop of 2 F inside for every 5 F decrease outside. This results in a common temperature of 70 F at the minimum; however, an inside temperature "floor" of 72 F is often preferred.

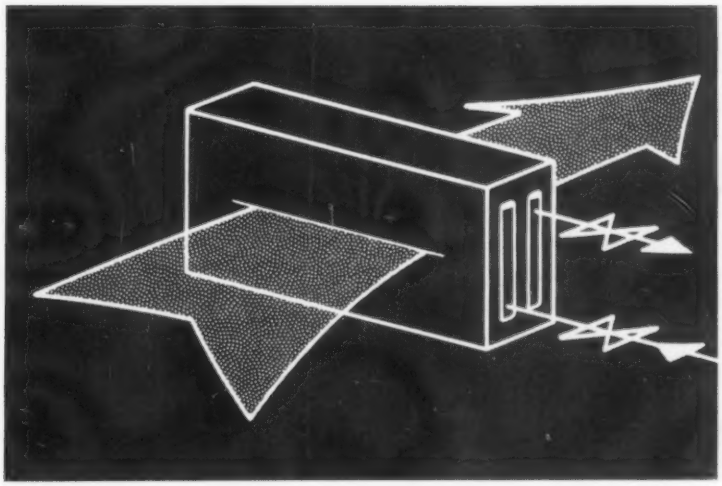
An alternative for automatic reset control is to keep the system set for 76 F inside temperature at all times. Manual reset is then required only when the outside temperature falls below 76 F. If the system is sized for 80 F at peak loads, it will not hold 76 F during extremely hot periods, but it will be working at top capacity, and any temperature of 80 F or less should be satisfactory.

Peak Load Hour Varies

Design load calculations must be based upon a specific time of day. The accepted hour in the United States is 4 PM Standard Time, which is probably accurate for the larger part of the country. Certain factors may necessitate a qualification of this however. For instance, a one story building with a heavy roof sun load may experience greater heat gain at 2 than at 4 PM. If a building has large glass exposure on the east side, the heaviest load might occur in the morning, or in the same case, the effect of the roof load might retard the peak hour until noon or 1 PM. Lastly, it must be remembered that if a substantial proportion of outside air is being introduced to the system, the cooling load from that air will increase markedly in the afternoon as outside temperature rises, so that the hour of peak load will tend to move back, closer to the 4 PM standard time.

Occasionally a designer will forget that there is an hour's difference between standard time and daylight saving time, and since the heat gain values found in reference books are based on standard time, a discrepancy can occur in the sun load calculations.

Cover photo courtesy Trane Co. ‡



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Lewis Smith
Heating Engineer

More on . . .

How to Provide Freeze-Up Protection For Heating and Cooling Coils

IN JULY of this year, Don Bahnfleth, HPAC Engineering Editor, prepared an Engineering Data File on the subject of *Freeze-Up Protection for Heating and Cooling Coils*. From the extent of the comments received, it is apparent that it is being widely accepted as a valuable addition to the literature.

Ordinarily, comments received on the engineering aspects of HPAC articles are published in our "Open for Discussion" pages. Because of the extensiveness of the reaction to this Data File, however, and because we feel many of the remarks form a constructive addition to the subject matter, some of the more important analyses are presented here, as a sequel to the July feature.

The engineers whose comments appear on the following pages are identified above.

Everetts: *"If your recommendations are followed, a major portion of coil freeze-ups due to improper trapping can be avoided."*

AIR MIXING to provide a temperature which is reasonably close to the average and to eliminate stratification has always been a difficult problem. The case is indeed remote where there is a possibility of mixing a cold stream of outside air with return air to give any reasonable average of conditions. The safest and probably the best method of preventing freeze-ups due to stratification is, as indicated in the article, to provide the proper heating coils in the cold air stream.

Mixing Can Affect Fan Capacity

There is another very important factor to con-

freeze-up protection for heating and cooling coils

sider, particularly in ventilating systems where the air mixing takes place at the fan inlet chamber. If an attempt is made to mix the cold and return air streams by tubulence, then you run into the problem of reducing the fan capacity because of the increased pressure at the inlet of the fan due to this turbulence.

Baffling Corrects Short Capacity

In a recent case, we found a fan which was specified to handle 60,000 cfm was only handling 41,000 cfm because of turbulent conditions at the fan inlet. Most of this turbulence was corrected by proper baffling of the air in order to get streamline flow which raised the fan capacity from 40,000 cfm to 57,000 cfm. By a slight adjustment in fan speed, the capacity was brought up to that specified.

In an article of this type, there cannot be enough emphasis placed on traps and an excellent job has been done in this respect. If your recommendations are followed, I am sure that a major portion of freeze-ups due to improper trapping will be eliminated.

Continuous Circulation Is Successful

In connection with the cooling coils in air conditioning systems where the cooling cycle is shut down for the winter, we have in many cases used the practice of providing two-speed pumps in which the high speed would be used in the summer time for circulating the chilled water, and in the winter time the pumps would operate on low speed to provide a circulation through the cooling coils at any time the outside temperature was below 35 F. We have not had any reports of freeze-ups in cooling coils using this arrangement.

Has Success With Glycol

We have also been successful in using glycol solutions in the cooling cycle without it being detrimental to the performance of the system. Cases where we have had cooling coils freeze up were due to installation problems, poor drainability of the coils, and lack of complete knowledge on the part of the operators.

The author of this article (Don Bahnfleth, HPAC Engineering Editor) should certainly be congratulated for a great contribution to our industry.

Rottmayer: *"The use of moving water in a heat transfer coil is the practical answer to freeze-up."*

AFTER READING this comprehensive collection of lore, I am compelled to expose my general impression of the subject. There is much ado about the ills that result from unfortunate design. Most of what has been written on the subject of preventing freeze-ups deals with correction of faults that result from misapplication of equipment and faulty design. This is akin to a doctor's treatment of symptoms of an illness, rather than removing its cause.

If freeze-ups are to be avoided, it is better to employ a stable liquid (water) as the heating medium, than an unstable gas (steam). Water can be varied in temperature easily and stably over a wide range (33 F to 250 F or higher) and its control is simple. Water will not freeze in a pipe if it is kept moving. It follows that the use of moving water in a heat transfer coil is the practical answer to the so-called freeze-up problem; as well as the logical answer to temperature control problems created by modern intricate heating and ventilating systems.

Pierce: *"Engineers should emphasize the use of vacuum breakers . . ."*

I HAVE READ with interest the HPAC Engineering Data File on coil freeze-ups in the July issue.

I believe it is substantially correct to say that modulating control produces "starving" in a distributing tube steam coil. In effect, at a light load, the control valve admits a smaller quantity of steam into the coil than would be required to fill it at full capacity, but which is sufficient to produce the vapor temperature and pressure required for the reduced load. The vacuum breaker then admits enough air to bring the total pressure in the coil up to atmospheric. This is, of course, an idealistic picture. In actual practice the dispersion of the vapor and air would probably not be rapid or complete enough to obtain complete equilibrium. This is why the distributing tube is needed since it physically distributes the small amount of steam over the length of the coil rather than depending entirely on vapor pressure dispersion.

Importance of Vacuum Breakers

Air must be admitted to the coil, therefore, for temperature control as well as to prevent the hold-up

of condensate within the coil. For this reason, I feel that engineers should place considerable emphasis on the use of vacuum breakers. Further, I do not believe that a vacuum breaker on the coil inlet only is entirely adequate. For example, suppose that the steam supply is throttled to the point where there is just a slight positive pressure at the coil inlet. This pressure would prevent a vacuum breaker on the inlet from admitting air to the coil. At the same time, due to the pressure drop of steam flowing through the coil tubes, the pressure may be less than atmospheric at the coil return. This slight vacuum at the return can prevent flow of condensate from the coil.

In this case, the vacuum breaker at the inlet would not be effective and it would be necessary to have a vacuum breaker at the coil return.

Inlet vs Return Location

There is some thought that locating the vacuum breaker at the coil inlet provides better control at light loads, where subatmospheric steam temperatures are required, than locating it at the return. It appears that this arrangement should give better mixing of air and steam in the coil, providing a more even temperature throughout.

Tests in our laboratory, however, did not substantiate this idea. At least, there was no detectable difference in the temperature distribution pattern whether the vacuum breaker was on the inlet or the return when testing a coil with 10 ft tube length down to as low as 10 percent of full capacity.

Capacity Reduction Should Be Adequate

In a vacuum return system, vacuum relief will act to equalize the pressure between the coil and the return line. I have no specific test observation data to tell if in this case capacity reduction will be severely limited due to the flow of relatively high temperature flash vapor from the return to the coil. By deduction, however, I believe there are two reasons why this arrangement is not particularly limited. Most likely, under the light loads existing when this situation occurs, the condensate is sub-cooled to a considerable degree in the coil so that there should be very little, if any, flashing in the return line. In addition, there is resistance to the flow of the flash steam, if it exists, back into the coil, and this resistance could readily prevent the return of enough vapor to the coil to seriously interfere with the reduced temperature operation.

Alyea: *"Many people seem to neglect the part of the problem that has to do with balancing the system."*

I HAVE READ *How to Provide Freeze-Up Protection for Heating and Cooling Coils*, and the comment I have is in connection with the need for maintaining flow of water through water coils whenever the entering air temperature is below freezing. Many aspects of this point are covered, but one which a lot of people seem to neglect has to do with balancing the system.

If a system is sufficiently unbalanced, and particularly if it is a direct return system, certain coils in the circuit can be completely starved of flow while other coils receive an excessive amount of water. With automatic control valves on the coils, this condition will tend to correct itself as the building begins to warm up; but in the meantime, those coils without flow may very well freeze.

It is extremely important that the water circuit be carefully designed, that a reverse return system be used if possible, and that the contractor does not neglect to balance the system.

Smith: *"The vacuum return system makes freeze protection of steam coils much simpler and more effective."*

THE HPAC Engineering Data File on coil freeze-up protection in the July issue is a valuable contribution to the industry, and I compliment you not only on the material contained in the article but for the manner of presentation.

There is however one section of this article which in my opinion could possibly be misleading. This is the section on steam coils. Mr. Crysler described two ways of reducing coil capacity by lowering the steam pressure within the coil, but says the effect is limited due to the difficulty of removing the condensate or of air bleeding back into the coil through vacuum breakers.

He says in part ". . . Steam coils using proportional control can be a problem if the inner workings of the coil under all load conditions are not clear. . . In vacuum return systems, the mechanism is not so clear, but the steam bleeding back into the coil through the vacuum breaker will be at a lower temperature and control will be achieved."

My contention is that this "mechanism" is very clear, and makes freeze protection of steam coils much simpler and more effective.

Notes Widespread Use

Thousands of heating systems operate today at 2 psi when the maximum output is needed, but are

freeze-up protection for heating and cooling coils

controlled so as to circulate the steam through the radiation units themselves at decreasing sub-atmospheric pressures as the weather moderates, down to a vacuum of 25 in. Hg. And obviously at least one control system to effect such operation has been commercially available for some time. This same idea can be and has been used for the control of coils using outside air. It is especially effective for coils with inner distributing tubes.

Describes System Operation

The system I speak of requires a properly designed proportional control of the steam flow to the coil, and a controller to keep the vacuum pump running to the extent necessary to maintain a greater vacuum on the return side of the trap at the outlet of the coil than exists in the coil itself. In this way, in areas where the outdoor design temperature is 0 F or higher, the coils are kept full of steam and clear of condensate at a temperature varying from 225 F (5 psig) at 0 F outside temperature down to 133 F (25 in. Hg) in 40 F weather. Thereafter partial filling of the coil may take place to a moderate extent as the outside temperature rises, but since this cooling occurs more or less over the whole coil surface, there should be no trouble with stratification of the outside air, especially if the precautions noted in the Engineering Data File are observed in the original design.

Where the coil is supplied with all outside air at temperatures below 0 F, a preheater coil would be necessary, as illustrated in the Data File Figs. 5 and 6.

Obviously a vacuum pump capable of operating to maintain a vacuum of 25 in. Hg in the coil is needed for such a system. If the coil in question is only a minor part of a heating system not otherwise designed to operate at high vacuum, then it would probably not pay to install a separate vacuum pump, but where there are a number of coils forming the major part of the heating system, it would be a paying investment to stand the moderate extra cost of a proper vacuum pump along with the necessary control equipment.

Tests Show Advantages of Vacuum

As to inner distributing tubes, I participated some years ago in a test of a school unit ventilator which has characteristics similar to the large coils the Data File discusses. A proportioning valve controlled the steam, and there was a pump which could maintain as much as 26 in. Hg vacuum or no vacuum at all. A dozen thermometers were located across the outlet grille. The difference in performance under the two conditions of vacuum or no-vacuum was quite remarkable.

With no vacuum, cold spots began to appear as the steam was throttled, until finally the whole return end of the coil was completely cold.

With the vacuum in effect no cold spots appeared and the air over the whole face of the grille was at a uniform temperature until the vacuum in the coil reached 25 in. Hg.

It seems to me that use should be made of the natural characteristic of steam to expand and cool down rapidly under a vacuum, and that it should be recognized that the steam table doesn't start or stop at atmospheric pressure, but is just as useable below that point as above it.

McFarlan: "*Possibly we should re-examine the whole (freeze protection) situation . . . with a more logical approach to the problem.*"

YOUR "HPAC Engineering Data File" in the July issue entitled, *How to Provide Freeze-Up Protection for Heating and Cooling Coils* has been read with considerable interest. This is the most complete compilation of data on the subject of coil freeze-ups that I have seen and should prove invaluable to design engineers especially.

While the article is all-inclusive of present material on the subject, I am wondering if after five more years of experience, we will still be confronting freeze-up problems largely because of the innumerable rules and combinations which must be put together or avoided, and because all of these combinations cannot be remembered in the design stage.

If they could be foreseen a great amount of expense could be eliminated by an entirely different approach to the subject, which eliminates the most important factors involved in freeze-ups. There will always be failures of controls or sticking of outside air dampers due to freezing. However, if we eliminate the maximum damper and confine the opening to a maximum of about 25 percent customarily used for summer ventilation, then many of our problems will be eliminated.

The problem then is only to control stratification so that the air is thoroughly mixed with about three

parts of return air to one part of outside air. Unquestionably, the varying of the mixture and the possibilities of increased quantities of outside air above the necessary ventilation rate is causing, directly or indirectly, many freeze-ups which could be prevented if this hazard were eliminated.

Recommends Three Pipe System

This means that we must provide continuous refrigeration during the heating season, and presents certain other problems. It is these problems which led to the development of the three pipe system throughout the building, and the "closed cycle." By a double condenser circuit, heat dissipated from the condenser is employed usefully so that it is, in most cases, less expensive to transfer heat than it is to generate it. The amount of heat available from the condenser is, in most buildings, less than that required in the periphery, especially with large glass exteriors, whenever the outside temperature is below freezing.

Building Character Fosters Problem

The increasing frequency of large interior areas in buildings requires continuous cooling to be available the year 'round. Presently most of these interiors are handled with the so-called "100 percent outside air system." This entails a mixing of variable quantities of outside and recirculated air to produce a mixture sufficiently low in temperature to remove the internal heat generated in the building interior. This in turn requires an exhaust or return air fan in order to permit the increased quantity of outside air to enter the space.

While one day during the heating season may produce a temperature of upwards of 55 F outside, which is frequently too high to remove the internal heat even with 100 percent outside air, a few days later the temperature may be 0 F. When the outside temperature drops below 32 F, there is always the possibility of improper mixing so that stratified air below 32 F will pass through a coil in such a way as to cause freezing. Just so long as such a possibility exists, the freezing hazard will continue.

Cites Economies in Solution

In addition to eliminating a hazard and solving problems simply, the space saved by the elimination of double fans, triple dampers, intermediate duct connections, spill air shafts, etc., returns a very large amount of space to useful and income-producing areas. It is actually cheaper in most cases to eliminate this equipment and provide the double condenser circuit than to purchase all of the additional controls, double fans, etc. which are probably the major contributors to the freeze-up hazard.

When so much can be written on a subject, this fact alone is impressive. With the great number of design engineers involved in air conditioning systems, it is hard to imagine all of this material being assimilated and the hazards checked against the possibilities brought out in this article.

There Will Be Other Answers

While one example is given above to eliminate the hazards, there are unquestionably other new methods which also eliminate hazards. For a number of years the industry has been adding controls and equipment to the systems in order to solve one problem — frequently creating two. Possibly it is time we re-examine the whole situation, and take a chance on starting from scratch all over again, with a more logical approach to the problem.

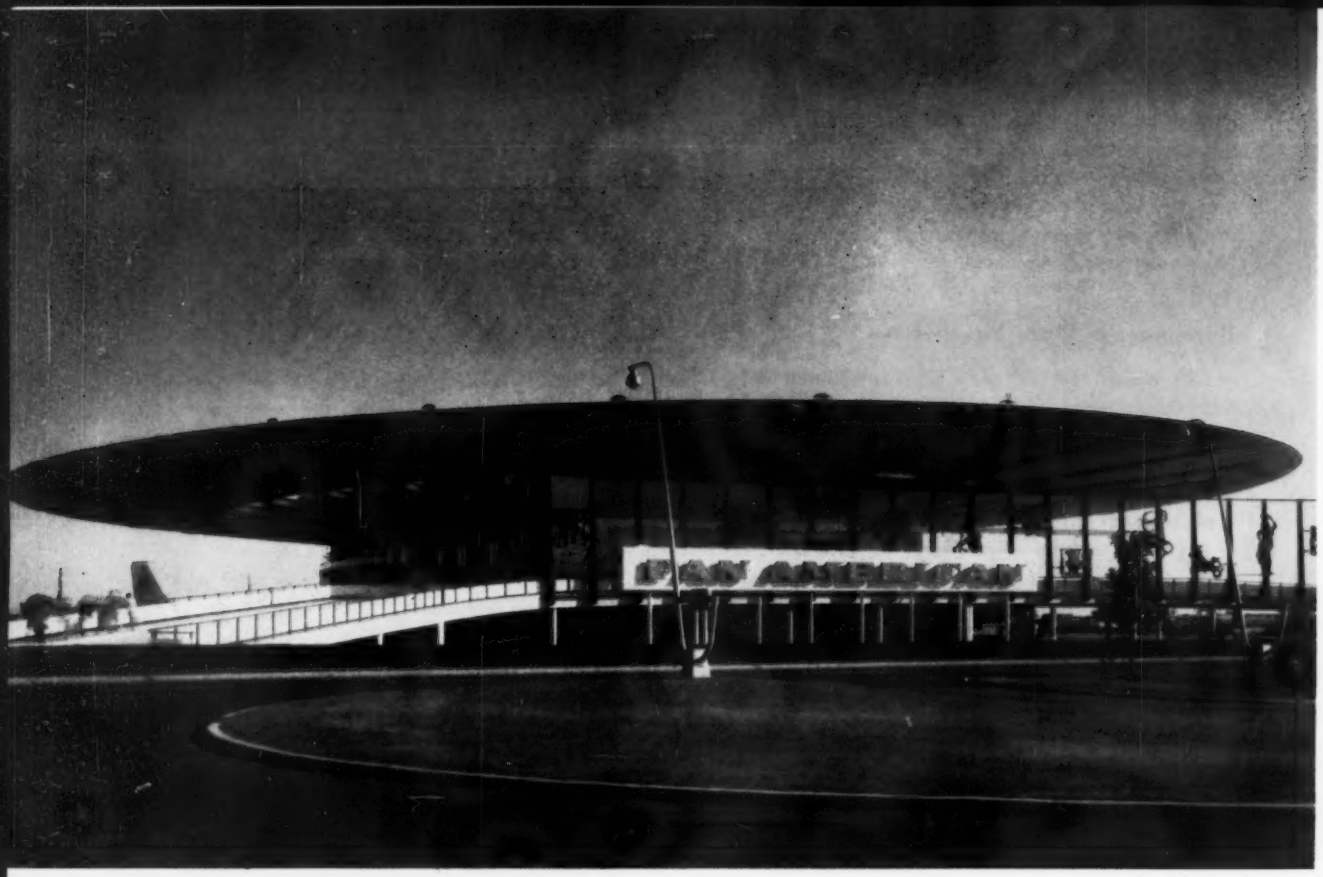
In the HPAC Engineering Data File on Coil Freeze Protection (July), some discussion was included on the subject of protection for idle cooling coils.

In that discussion, it was noted that lay up of cooling coils requires *complete* drainage of the coil and associated piping, and that the success of this operation presupposed that the coil itself would be designed so as to provide a downward pitch in the casing toward the drain cocks. In addition the installation piping must be arranged to insure proper drainage of all tubes and both headers.

The statement was made that even though coil manufacturers agreed with and provided these design features, there was considerable evidence that, for several reasons, coils do not always drain completely. A survey conducted by the Mechanical Contractors Association of America was cited which indicated the frequency and conditions of coil freeze-ups.

It should be noted that the freeze-ups reported in that survey occurred with coils which did *not* meet the two provisions for proper drainage noted above.

It should also be noted, however, that even when these design features are provided, some engineers remain apprehensive because rough handling during shipment or installation, or even improper installation, can result in low points in the coil which will not drain properly. Therefore either a low pressure air blow-through or an ethylene glycol flush of the coil is good insurance in any case.



"Conventional" Air Conditioning Meets the Modern Building Challenge

By LEWIS SMITH
Heating Engineer

Huge modern air terminals being constructed around the country occasion much comment — architecturally, from the public, and mechanically, from heating, piping, and air conditioning engineers.

In this article Lewis Smith, a frequent HPAC contributor, explains how excellent but conventional air conditioning designs have been made to fit the unique building requirements of the three newest terminal buildings at New York's Idlewild.

SIXTY YEARS or so ago, architects used the design of railroad terminals to give free play to their imaginations. History repeats itself — today architects are being presented with this same opportunity but on a grander scale in creating air line terminals. Now, however, they no longer need to work in the confined areas of large cities. Today they can work in the open spaces of air fields where people can see and enjoy the designs from inside and out.

A great deal more room is needed for parking and loading planes than is required for trains. Consequently these air terminals are on a scale far beyond the old railroad depot. For instance, at New York International Air Port (Idlewild), each of the three newest buildings — Pan American with its oval umbrella roof, Trans World Airlines with its sweeping curves, and United Air Lines with its vast vistas — is as large as all facilities at many older air terminals.

Yet in spite of the grand scale and novel design of these buildings, the air conditioning systems are all of the conventional type — low pressure duct systems supplemented by convectors or finned pipe for ad-

ditional heat — a testimonial to the excellence of today's mechanical design methods.

What did tax the ingenuity of engineers, however, was the problem of how to fit these systems into the unusual building structures and job conditions. A factor of considerable importance was the need to protect the interiors against the entrance of fumes generated by jet engines. To further complicate matters, Idlewild is for the most part built on filled land near the ocean, so that the water table is only 4 to 6 ft below grade.

Use Central Heating-Cooling Plant

Early plans for the air port called for the construction of a central plant to serve all buildings with hot and chilled water.[1] This plant is designed to deliver water at 400 F for heating with a 160 F temperature drop, and 45 F water for cooling with a 10 F temperature rise. Chilled water is used directly in the air conditioning units of each building, but the hot water, generated at a pressure of 300 psi, is passed through converters from which water at 250 F is obtained for space heating, and steam at medium pressure is generated for other uses.

Pan American Building

The Pan Am building is noteworthy for the vast oval roof of about four acres which overhangs the main building and provides sheltered berths for loading and unloading planes. The main axis of the roof is 528 ft long, the short axis 428 ft. The building itself is three stories high, 446 ft long and 67 to 129 ft wide, mostly glass enclosed. A second floor main passenger concourse allows customers to walk directly through ramps into planes parked alonside the building.

Huge Air Curtain Gives Access

At the main entrance, also on the second floor and accessible from an automobile ramp, one encounters the first of several factors which influenced the design of the air conditioning system. This is an air curtain of extraordinary size, fully 89 ft wide and 10 ft high.[2] The air curtain alone recirculates 600,000 cfm of air at 3 in. WG, provided by six axial flow fans each driven by a 75 hp motor.

For proper operation of the curtain, especially when wind velocity is high, it is necessary to keep the interior of the building under some pressure, and air conditioning units had to be sized with this in mind. An additional reason for pressurizing the building was the need to exclude jet engine fumes, which are considerable even when the engines are idling. For this reason also, almost 100 percent outside air is used in the air conditioning units.

Air conditioning of waiting planes — usually taken care of by portable heating and cooling units

[1]O'Reilly, W. T., *Huge HTHW System Supplies Unique Heating-Cooling Operation*, Heating, Piping & Air Conditioning, Vol. 30 Nos. 2 and 3, February, March 1958

[2]Zehnder, Norbert, *Wind Tunnel Tests Help Design Air Curtain Entrance*, Heating, Piping & Air Conditioning, Vol. 32 No. 12, December 1960

Pan American World Airways Building
Architects & Engineers:
Tippetts-Abbett-McCarthy-Stratton
Associate Architect:
Ives, Turano and Gardner
Air Conditioning Contractor:
Norman Heating Co.

United Airlines Building
Architect:
Skidmore, Owings and Merrill
Consulting Mechanical Engineer:
Syska and Hennessy
Air Conditioning Contractor:
A. D. Walker & Co., Inc.

Trans World Airlines Building
Architect:
Eero Saarinen & Associates
Consulting Mechanical Engineer:
Jaros, Baum & Bolles
Air Conditioning Contractor:
Brandt Corp.

which are truck mounted — is handled in a unique fashion at Pan Am. Pits have been built under the loading platforms from which flexible connections can be made to the planes. Underground ducts connect from these pits to units in the machine rooms of the main building. About 3000 cfm of conditioned air is needed per plane.

Deliver Air from Above and Below

Concourse air conditioning is accomplished through ceiling outlets at the central skylights and baseboard type air diffusers along the exterior walls. The latter serve to blanket the large glass surfaces. Convectors and finned pipe are installed as needed for supplementary heating.

The present maximum demand for air conditioning is about 600 tons of refrigeration, but it is anticipated that this demand will rise to about 750 tons when a future extension is built.

United Airlines Terminal

A curving main building 700 ft long and 110 ft wide, with two wings or fingers on the aircraft apron side, serves as the terminal for United Airlines, with the second, shorter wing leased to Delta Airlines.

A 500 ft long lobby, two stories high, occupies the front of the building, with service areas located in the rear and at each end. Above the service areas is a mezzanine with entrances to the finger buildings.

The entire lobby is conditioned by air which is supplied from concealed grilles in 18 in. wide slots on 30 ft centers in the ceiling, by low grilles along the bottom of the glass front, and by grilles in the face of the balcony which forms the mezzanine floor.

Return air is handled through ceiling grilles and others located at the rear of the lobby. Service areas also have finned pipe along the exterior wall for auxiliary heating.

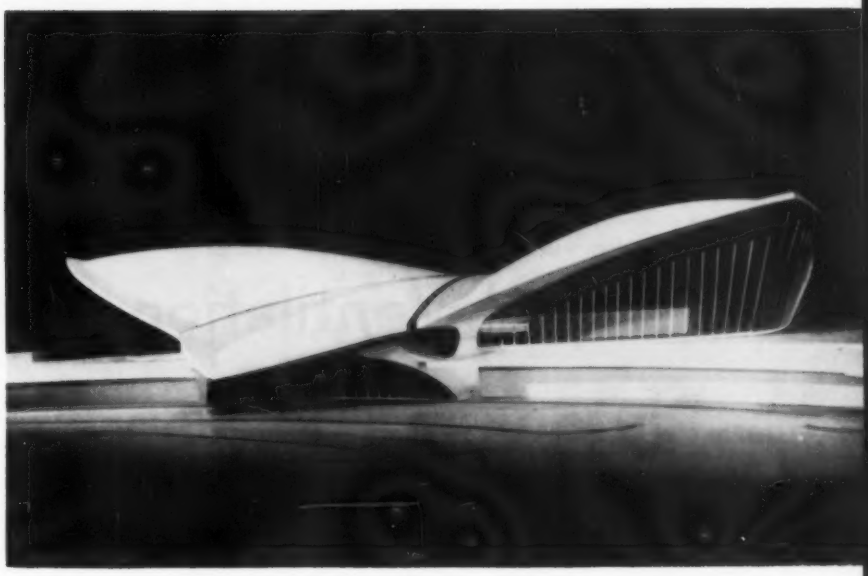
House Equipment Topside

A continuous monitor on the roof houses most of the air conditioning equipment for the main building. Outside air is taken in through grilles on the front of the monitor and return air is discharged from the rear, back towards the aircraft locations. This is to eliminate the danger of fumes entering the system regardless of wind direction or velocity.

The finger buildings serve as concourses with waiting areas for enplaning passengers. Air conditioning equipment for these spaces is located at ground level beneath the concourses. To provide for fume exclusion in these areas, each unit is equipped with a special filter of radio-frequency and electrostatic components designed to trap dust and fumes.

AIR DISTRIBUTION in United Airlines terminal is via grilles concealed in 18 in. slots spaced 30 ft on centers across lobby

Photos of United Airlines building courtesy Peerless Electric Div., H. K. Porter Co., Inc.



TERMINAL for Trans World Airlines, now under construction, includes crescent shaped center building, two wings, and long bridges to ramp houses where passengers will embark to planes

Air distribution in the finger buildings is by ceiling outlets, supplemented with finned pipe for heating under the low windowsills. The entire United complex requires a maximum simultaneous air conditioning capacity of about 1000 tons.

Trans World Airlines Building

Still under construction, the TWA terminal will present a most striking appearance, with a four-part fluted roof over the center portion and a crescent-shaped plan overall, including two wings.

The area beneath the main roof is devoted to an entrance lobby at ground level, a waiting room on a higher level in the rear, and a third elevation for restaurant and other facilities. This entire area is open, with no supporting columns, and with the great areas of glass walls, the use of ducts to reach ceiling distribution outlets was precluded. Instead, design engineers conceived the idea of using what are termed "air fountains," located at three points around the interior, which "spill" conditioned air from outlets 8-1/2 ft above the floor.

One such fountain is built into the information desk at the entrance, and the other two are located towards the rear at the waiting room level. The latter two contain lighting fixtures as well as the air distribution ducts. Supplemental air is delivered along the bottom of the glass walls at the waiting room level and through additional ceiling outlets over the third elevation.

Bridges Lead to Planes

Extending from the rear of the main building, and forming an angle of 77 deg between them, will be two long bridges (only one can be constructed at present because of operational restrictions). These will terminate in so-called "ramp houses" where passengers can wait for planes. The entire arrangement will provide for 14 planes to load at one time, with moveable loading bridges extending from the ramp houses.

Underslung Ducts Supply Air

Two sheet metal air supply ducts will be installed beneath the floor of the one bridge now under construction, extending from the main building to the ramp houses, with outlet grilles on each side of the bridge at floor level. Air is supplied from the terminal system and returned through the enclosed passageway of the bridge.

Remote Spaces Have Separate Units

The present ramp house has a mechanical equipment room at ground level, containing a single two-zone air conditioning unit. One zone handles the ground level, operating personnel, spaces, and the second supplies the waiting room above.

Two extensions lead further out from the ramp house to other aircraft parking. Each of these extensions also contains a waiting room. One is equipped with a two zone unit for the passenger area and extension bridge, and the other has a three zone unit — the added zone being used for a control tower on the roof.

To exclude jet engine fumes, air supply for the ramps comes from inlets on top of the main building wings, and passes through ducts incorporated in the bridge structures. ≠

Two years of operational experience permit a factual critique of the

Hood Ventilation in Argonne's Plutonium Fuel Fabrication Facility

By R. M. MAYFIELD
and
H. BAIRIOT*
Metallurgy Div.
Argonne National Laboratory

THE Plutonium Fuel Fabrication facility at Argonne National Laboratory was put into operation almost two years ago to develop methods and techniques for the fabrication of plutonium and other similar alpha radio-active, toxic, and pyrophoric materials. The project has been a success, but not without operational difficulties, considerable revision of the ventilation controls, and detailed study of proper operation of the interrelated ventilation systems.

Ventilation details of an overall facility nature were reported in the December 1959 issue of Heating, Piping & Air Conditioning and will not be covered here. Suffice to say that the facility was designed to process extremely toxic raw materials with maximum safety to the operational personnel, the laboratory, and the surrounding community. The hood ventilation system provides one of these critical means of control.

Initial Design, Operation

A "herringbone" arrangement of hood lines, or glove boxes, is located in the fabrication area of Facility 350. Either air or helium is employed as the hood atmosphere, the choice being largely a function of the state of the material and the operations to be performed. At present, seven hood lines are operated on air only, with no provisions having been made for the use of a helium atmosphere. Other hoods employ a helium atmosphere. Provisions have been made for converting the helium hood atmospheres to air if required.

The ventilation system for the air hoods works this way. Room air is drawn into the hood through one or two AEC high efficiency filters (99.95 percent efficient to 0.3 micron particulate matter) located in a filter box on top of the hood. The filters, having glass fiber media in asbestos or metal frames, are fire resistant. Exhaust from the hood passes through a similar type filter, through a manually operated 5 in. rubber lined butterfly valve, and into the normal (air) exhaust system ductwork.

The ventilation of the helium hoods is illustrated in Fig. 1. The helium supply enters the hood through slots in the lower hollow aluminum extrusion. Exhaust helium passes through similar slots in the upper extrusion and into the helium return ductwork. The 5 in. valves on the helium supply and return are electro-pneumatic in operation but manually adjusted for proper opening.

For either air or helium ventilation, the operation pressure within the hoods is held at approximately

*H. Bairiot is now a staff metallurgist at BelgoNucleaire, Mol, Belgium

−0.6 to −0.8 in. water gage with reference to the room. Individual hood adjustment is manual as mentioned above. An auxiliary or "purge" exhaust is available to each hood to provide an automatically regulated flow of approximately 400 to 500 fpm of air through any planned or accidental opening in the hood. At least 150 fpm air flow is required to prevent counter migration of airborne plutonium oxide or contaminated dust. Migration of extremely small quantities of this highly radioactive material could completely contaminate the working area.

Operation of the purge system is completely automatic. The 10 in. rubber lined butterfly valve is actuated and modulated by the pneumatic controller and pilot positioner. The creation of a hood opening, of sufficient size, will produce a decrease in pressure differential. This pressure change will dictate to the controller the amount of valve action required to maintain the prescribed flow of air through the opening. When the hood is sealed, the valve will close and the normal exhaust or helium ventilation systems will then return the internal pressure to the preset value.

Certain complications could arise from the unscheduled entrance of rather large quantities of air into the helium hoods. Therefore, the helium supply and return valves are electrically closed whenever the purge valve operates. A manual reset is required. In addition, an alarm buzzer and signal light have been provided on the lobby alarm panel to indicate when a hood purge system is operating for any reason.

The Type I pneumatic controller is illustrated schematically in Fig. 2. The diaphragm responds to very slight changes in pressure differential. These changes vary the control port (leak port) bleed off rate, modulating the branch pressure output of the air relay to the Type I pilot positioner and valve motor. The action of the controller is linear, at or near the control point. That is, the output pressure varies directly (or inversely depending on the relay employed) with a variation in differential pressure across the diaphragm.

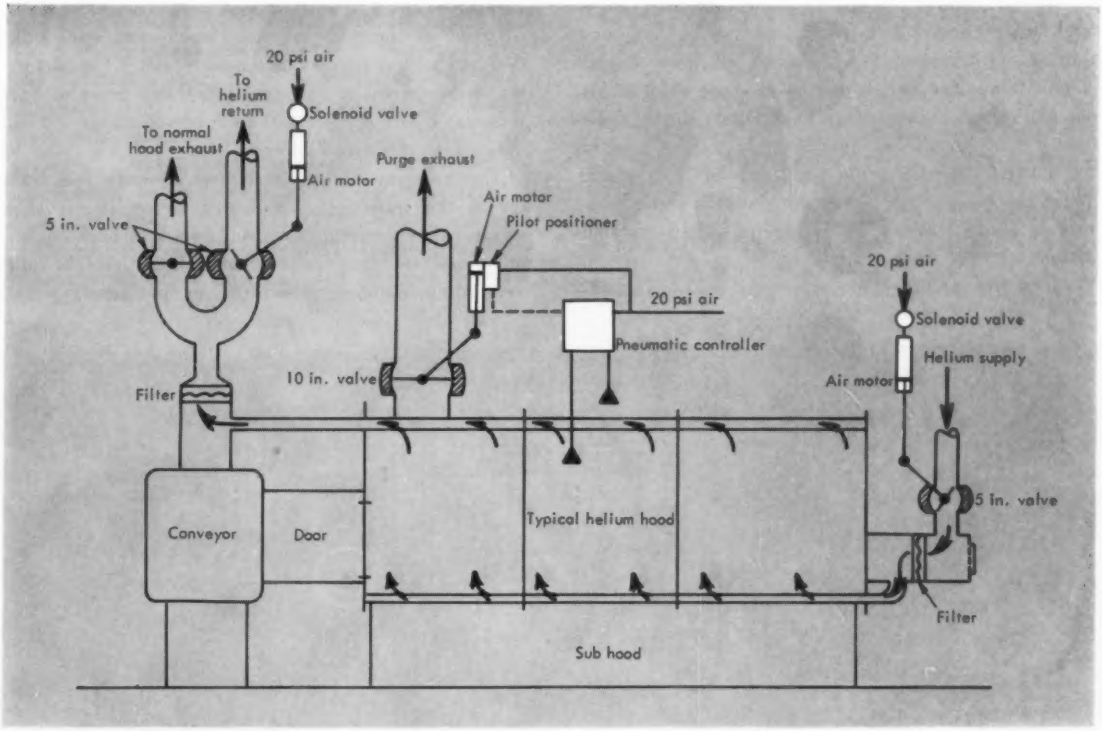
The rubber lined butterfly valves were included in this application for two reasons. First, they were the only type and size available at the time that proved suitable for sealing the ventilation systems without leakage, as determined by helium mass spectrometer leak detection. Second, the butterfly valve characteristic curve is not wholly linear, tending more toward the equal percentage type at smaller openings. It was reasoned that better velocity control might result from the combination of this valve and the linear action of the controller.

Velocity through a hood opening will vary as the square root of the velocity pressure:

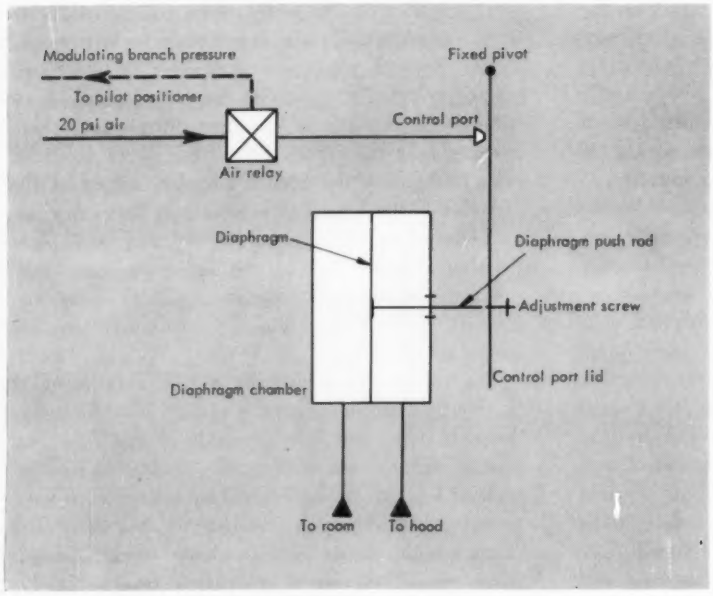
$$V = K\sqrt{P_v}$$

or

$$V = 4005\sqrt{P_v} \text{ at Std. Conditions (1)}$$



1 VENTILATION of helium hoods necessitates precise controls and instrumentation



2 ACTION of the Type I pneumatic controller is linear, at or near the control point

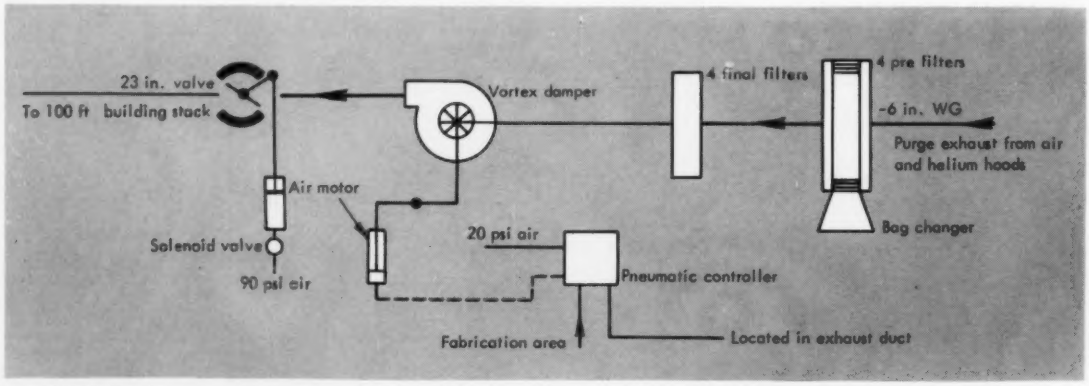
A quick opening, or linear acting valve would not be the most desirable based on the prescribed operational requirements.

The purge and normal (air) exhaust fans and filters, located in the fan room, are shown in Figs. 3 and 4. There are two identical purge systems, one serving the conveyor hoods as well as three other confined areas, and the other serving the balance. The prefilters for the purge system are located in stainless steel bag change filter boxes. Each filter box contains four fireproof media, AEC high efficiency filters clamped in place. After prefiltering, the exhaust air passes through four similar final filters, through the fan, the 23 in. rubber lined butterfly valve, and to the outside atmosphere via the 100 ft building stack. When the hood purge valves are closed, a static pressure of about −6 in. WG is maintained in the duct system.

All of the air hoods are served by one normal exhaust system. Prefilters are located in the hood lines; therefore, only final filtering is required in the fan room. In operation, this system is similar to the purge system except that it is under constant load. The static pressure in the filter duct is controlled at approximately −3 in. WG.

Welded aluminum pipe or duct is employed in the exhaust systems connected directly to the hoods. The balance of the duct system is of welded stainless steel. All pipe or duct and all hood enclosures were leak detected with a helium mass spectrometer leak detector, followed by a leak rate test. Leak rates of (or less than) 0.02 cfh per 100 cu ft of volume at −4 in. WG were considered acceptable.

The hood ventilation system shakedown was useful in the training of operating personnel. It also succeeded in ferreting out weaknesses in both equipment and design. The normal exhaust and helium ventilation systems presented no problems, while



3 PURGE exhaust system will provide 400 to 500 cfm through any hood opening

considerable difficulties were experienced with the purge systems. The pneumatic controller is the heart of the purge control action. This equipment presented most of the troubles that were encountered.

An erratic action of the purge butterfly valve was clearly evident. The angle of opening of the valve would shift up or down from day to day when tested under the same conditions; the same size hood opening (usually the door) being used as a standard. Continued tests and observations indicated that the control point of the pneumatic controller was shifting. This shift was found to be the source of trouble after conducting a long time test. The test consisted of holding a normal pressure differential of -0.6 to -0.8 in. WG on the instrument diaphragm (Fig. 2) for a week or more. When ultimately called upon to operate, there was no purge valve action at all in some cases, while in other instances, the valve opening might be anywhere from 0 to 90 deg. The majority of readings, however, were on the low side of the desired value.

The normal pressure differential of -0.6 in. WG is of the order of 60 times the value of the pressure differential at the instrument control point (approximately 0.01 in. WG for 400 fpm flow through the test opening — Equation 1). The controller diaphragm would take sufficient set, under these conditions, such that its control action was rendered completely unreliable at the control pressure differential. Direct mechanical measurements made on the Type I controller revealed that control port lid movements of less than 0.001 in. would produce a change of 1 psi in the output or branch pressure. Measurement on the diaphragm also indicated a hysterisis of action of approximately ± 0.001 in. from the extreme limits of movement in either direction to the center, or set point. It is not difficult to visualize that the control point could be lost under the desired operating conditions.

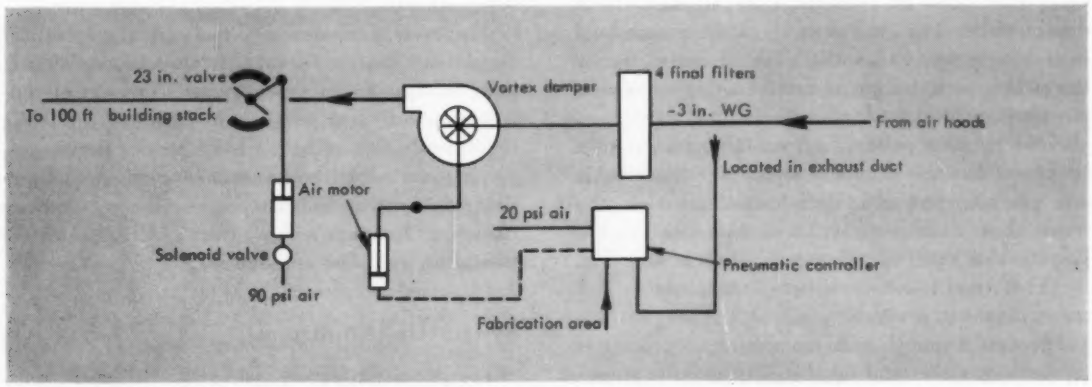
Operational tests on the Type I pilot positioner were carried out concurrently with those on the pneumatic controller in order to improve overall efficiency of operation. Careful measurements of angular valve opening vs branch pressure (supplied by a carefully controlled regulator) indicated different values of opening for increasing or decreasing branch pressures. This hysteresis proved to be responsible for some of the "hunting" that was noted in the early tests, being especially marked for small hood openings. Some of the "hunting" or lack of control was also traced to the rubber seats on the butterfly valves. Considerable pressure is required to firmly seat or unseat the valve, after which little pressure is required. This is not a favorable condition when attempting to control small air flows.

One must realize that certain unpropitious time lags are inherent in a pneumatically controlled system of this type. Stiffness of the sensing diaphragm, resistance of air flow through control ports, relays, etc., are present in the controller. In the air motor, the time necessary to fill or bleed off through the pilot positioner will be of importance. The time necessary to evacuate the hood to a higher or lower differential must not be overlooked. These time lags, combined with others less significant, make precise control difficult.

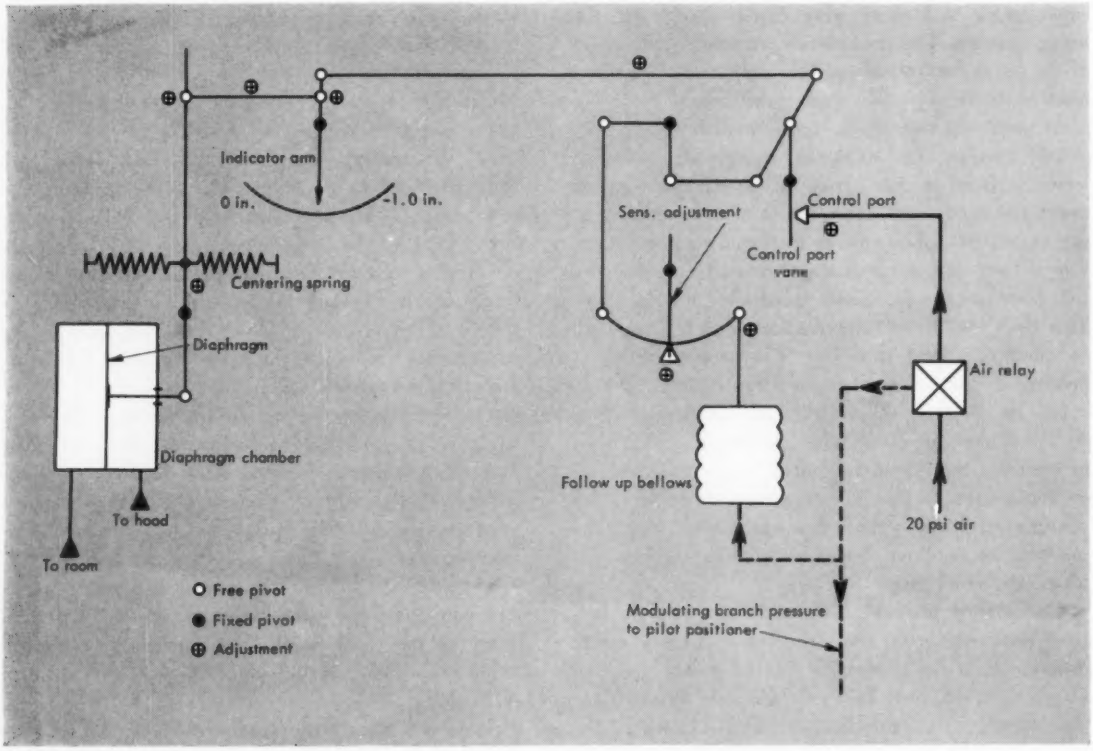
It is not the intent of this article to malign any standard commercial product. The Type I controllers and pilot positioners were included largely on the basis of economics. Both units perform in a highly efficient manner when assigned to the proper task. That task is to provide constant static pressure control with limited deviation and prompt and accurate correction or repositioning.

Replace Type I Units

The purge control requirements proved, with little doubt, to be beyond the capabilities of either the Type I controller or pilot positioner. Prompt replacement appeared imminent to the successful operation of Facility 350. The decision was made and a



4 NORMAL exhaust system is similar to purge system, but is under constant load



5 TYPE II indicator-controller allows closer adjustment than previous control

Type II indicator-controller with a 0 to −1 in. WG working range was selected as a replacement. The new controller has a large pressure scale and pointer, visible at some distance from the instrument. This pressure indication has proven extremely beneficial, eliminating the need for other auxiliary pressure gages on the hood lines.

The indicator-controller unit employs a diaphragm sensing unit similar to the earlier model except that the diaphragm is spring centered. Hysterisis in the unit is essentially eliminated. The action of the controller is illustrated in Fig. 5. One will note immediately that it is much more elaborate than the Type I unit, with many possible adjustments. Time has proven these adjustments to be necessary for a system of this type and most all of them have been used at one time or another. The design of the instrument is such that loss of control is minimized with any setting within the 1 in. range.

Following this pattern, a Type II precision pilot positioner was also chosen to replace the former unit. The precision unit proved to have little or no hysterisis, fast action, and excellent repositioning. The operation of the Type II unit is illustrated in Fig. 6. (The Type I unit consisted of mechanically balanced diaphragms with no air relay.)

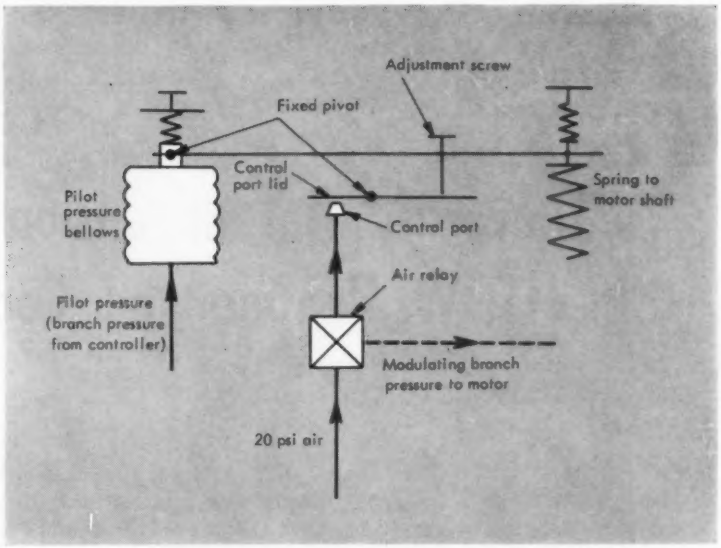
The two Type II units combined to produce a much more stable and considerably more expensive system. Long time tests as well as frequent exercising of the purge valves have indicated only minor changes in the control setting. The problem of seating and unseating of the rubber lined valves was corrected by adjusting the closing to produce only snug contact with the seat. This procedure has reduced "hunting" to an acceptable level without compromising safety.

Although the design operational range of negative pressure within the hood lines (−0.6 to −0.8 in. WG) has been acceptable, it has been found that the higher negative side of the range is to be preferred for two reasons: first, manipulations of the gloves by the operators will not cause the purge valve to be activated; and second, a higher operating negative pressure will handle a larger opening before the pressure rises sufficiently to activate the purge valve.

The corrective measures outlined above appear simple and straight forward. It must be emphasized, however, that an unexpectedly large amount of time was consumed in analyzing the systems; determining the control characteristics of the various devices employed; and establishing satisfactory operational procedures. The time will have been well spent if others can profit from our experiences in dealing with the difficulties that were encountered.

System Has Limitations

The purge ventilation system was designed primarily to provide a controlled flow of air through any



6 A Type II pilot positioner replaced the Type I, eliminating hysterisis

hood opening that might occur, either from planned or unexpected causes. This creates an immediate problem: how big an opening should one plan for with a guaranteed flow of approximately 400 fpm? We planned for the unexpected removal of one complete window (approximately 3 by 4 ft). The valves, ducts, and fans were sized on this premise.

So far we have not experienced the unexpected loss of a window from one of our Pu contaminated hoods and hope that we never will. We have, however, experienced the purge system operating for considerably smaller openings, such as a glove port. For such smaller openings, the purge system is oversized. The valves and fan system are too large to provide the fine control needed for relatively small openings — a decided limitation that is being tolerated. When none of the purge valves are open (which is the usual case), a static pressure of approx. −6 in. WG is available even though the pneumatic controller is holding the fan vortex damper in a closed position (Fig. 3). For small hood openings, this pressure differential is too great. Proper control is still under investigation.

This lack of suitable control leads to another problem. It is not altogether desirable to have a purge valve operate because of a transient pressure fluctuation caused by conditions other than hood openings. The hood pressure in this instance will be sent rapidly negative to, in some cases, the duct static pressure which may be −5 to −6 in. WG. The gloves are drawn in and a strain may be placed on them as well as on the CR-39 plastic windows. This is an undesirable condition which should be avoided.

It is the considered opinion of the authors that hood ventilation limitations will always exist in a system of this type designed for maximum safety. One can anticipate and solve many of the difficulties that may be encountered. Unsought for problems, however, seem destined to occur.

Recommends New Control

It would prove hazardous to propose broad recommendations for any hood or glove box ventilation system other than the one described. To date there is no standardization — each system being designed in a different way for a different even though somewhat similar purpose. Therefore, we will confine our comments to one specific phase of operation that may be common to many designs: the provision for an auxiliary or purge system such as ours and the method of instrumentation or control.

A need exists for an inexpensive apparatus to automatically regulate the auxiliary exhaust or purge valve openings of glove boxes. No real satisfactory and economical equipment exists today and many laboratories have gone to semi-automatic or even manual control. Since the safety of the operation eventually relies on the prompt and efficient operation of the purge system, a reliable automatic device is of utmost importance. Perhaps it would be electrical rather than pneumatic. Perhaps it would incorporate a sensitive static pressure transducer with sensitivity and reproducibility over a wide range rather than a diaphragm unit. Perhaps it would provide two separate systems — one for large openings, one for small openings. Whatever the nature, we strongly recommend that development work on such systems be undertaken to greatly improve glove box technology and safety. ⫩

University Has Expansion Flexibility In HTHW Heating and Cooling System

The University of Hartford was established in 1957 with plans for an initial six buildings. Master plans called for an additional 14 buildings to be built in the future. This presented the problem of how to design a heating and cooling system that would economically serve the smaller campus and still be flexible enough for adaptation to the larger campus. This article describes the system selected and operational results.

By EVERT M. JOHNSON
Professional Engineer
James S. Minges & Associates
Consulting Engineers

IN PLANNING the cooling and heating system for the University of Hartford in Connecticut, the consulting engineer had to make provisions for a large expansion that will be made in the future. The initial phase of construction calls for six buildings and a boiler plant, and the master plan includes 14 additional buildings for the 150 acre campus. The problem was one of selecting a cooling and heating system that would meet present needs, and at the same time have the flexibility to handle the larger load with additional equipment.

The first two buildings built in the initial phase are the General Classroom Building and the Boiler Plant. A high temperature hot water boiler supplies heat for coils in a high velocity double duct system and for an absorption type water chiller located in the classroom building.

Can Remove Boiler Plant Wall

Only one boiler, with an output capacity of 12,000 MBtu per hr, is being used at present, with space provided for an additional boiler of the same capacity. The fuel oil pumping and heating system has capacity for the second boiler. When additional power is required, one wall of the boiler plant can be removed and more equipment installed.

The outlet temperature of the boiler is 350 F. Since the present load is less than half of the 12,000 MBtu per hr capacity, the return temperature is now over 300 F to the boiler. The air handling coils and absorption unit are designed to operate through a temperature drop of 350 to 250 F at full load. Two electric motor driven pumps installed in the return line to the boiler are each capable of handling the full boiler load with approximately half the outlet water by-passed to the return at the boiler plant. This is required to maintain full flow through the boiler at all times. A flow sensing control on the boiler is connected to the limit circuit of the burner to prevent burner operation if flow should fall below a predetermined point.

The boiler is fired by a combination gas-oil burner of the wide range pressure atomizing type with

WHITE BUILDINGS shown in aerial view of model constitute the initial phase of six buildings on the University of Hartford campus. Darker buildings are planned future construction

forced draft, and is provided with compressed air soot blowers. A duplex pump and heater set handles No. 6 oil from an underground storage tank.

Mains Sized for Future Buildings

The mains of the distribution system running from the boiler plant are sized for the future buildings which are expected to be built in this area. The piping to the vicinity of the first building forms part of a rectangular "loop" which will be extended as more buildings are constructed. Manholes with valved branches are provided for future expansion. The entire high temperature hot water system is designed for 300 psig, and will allow some increase in operating temperature and a higher temperature drop if expansion of facilities requires.

The expansion tank is nitrogen pressurized with a fixed quantity of nitrogen to allow the pressure in the system to change with varying average temperatures. High pressure nitrogen bottles replace lost nitrogen, and an electric motor driven feed pump, manually started, feeds water to the system. High and low pressure alarm lights and fuel cut-offs are provided on the expansion tank along with high and low level indicator lights. The expansion tank is connected to the system on the suction side of the circulation pumps.

A dual duct high velocity fan system operating at 5½ in. SP is used in the General Classroom Building. Two supply fans installed in parallel, each handling 33,000 cfm, discharge into a common plenum and then through high temperature hot water coils in the hot duct and through chilled water coils in the cold duct. The fans have two-speed motors and inlet vanes. For night cycle heating, only one fan is operated, intermittently and on low speed. A return air fan discharges air outside the building or to a mixing box. Return air is mixed with outside air in response to a mixed air controller in the fan discharge for the heating cycle and in response to a velocity controller in the minimum outside air duct during the cooling cycle. Electrostatic filters with after-filters are provided. The total volume of the system is controlled by a velocity regulator on the suction side of the supply fans controlling the inlet vanes. The mixing-attenuating boxes do not have constant volume regulators.

The hot and cold duct mains run in a tunnel under the main corridors, with hot and cold ducts rising alternately at each 12 ft building bay. Mixing boxes located above the corridor ceiling in each bay

discharge air through a side wall grille into the classrooms. Each 12 ft bay has a mixing box which will allow flexibility for future relocating of partitions on a 12 ft module.

A 250 ton absorption machine is located in the machine room of the classroom building adjacent to the fan system. A built-up redwood cooling tower is located on the roof of the four story structure enclosed by an aluminum louvered fence.

In addition to the air supply system, a system of hot water finned radiation is installed under the window stools. This radiation is designed to take care of only a portion of the glass transmission loss. Glass areas are approximately 25 percent of the exposed wall area and fenestration is fixed. A converter supplied with high temperature hot water supplies hot water to this radiation. The only control on this system is by outdoor reset of the water temperature and a complete shut-down at 50 F outside air.

Temperature Controlled Pneumatically

The temperature control system is pneumatic, and has a graphic indicating panel in the machine room. The panel has pneumatically transmitted temperature indication of all parts of the air handling system and water system. Representative conditions of the systems are also transmitted to a smaller panel in the boiler plant. There is space on this panel for similar representation of systems in future buildings. This will allow the plant operator to keep watch on all systems from one location.

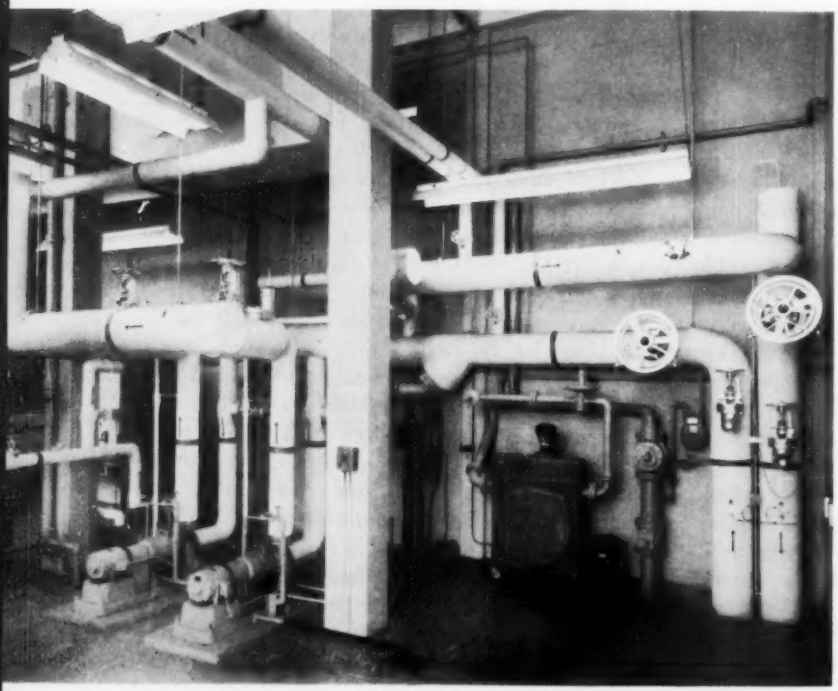
The plant has been in operation through one heating and one cooling season. There was considerable difficulty with the burner when firing No. 6 oil under low load conditions at the start of the heating season. Since the burner was capable of firing at a boiler output of 12,000 MBtu per hr and the load varied from 5000 down to as low as 1000 MBtu per hr, the burner was forced to cycle off and on. This caused considerable carbonizing at the burner tip. Firing with gas caused no problems, so the plant was operated on gas through the winter. This caused an increase in fuel costs, although the plant was operated essentially unattended, thereby saving in labor costs.

Burner Is Being Modified

At present the burner is being modified with a smaller fan wheel and burner tip to fire No. 4 oil at the lower rate. This will provide stand-by fuel for a lower interruptible gas rate.

The building heating and cooling system has presented few operating problems after the initial balancing was completed. By maintaining the total volume of the system constant, there is no appreciable variation in volume at any mixing box.

Alfred L. Jaros, Jr. of Jaros, Baum & Bolles, was the heating and cooling consultant in the initial planning stage. James S. Minges & Associates are the mechanical, structural, and electrical engineers. Architects are Moore and Salsbury. K. R. Graham Inc. are the heating and air conditioning contractors.



MAINS in HTHW system are oversized to allow for future expansion

It is well to pause occasionally in the practice of engineering to review some of the *ideas* of engineering — including the exact function and purpose of familiar mechanical equipment items. This article affords such an opportunity in the field of piping; on

The Installation and Use of Pipe Guides

By W. P. GREGORY

and W. C. WHITE
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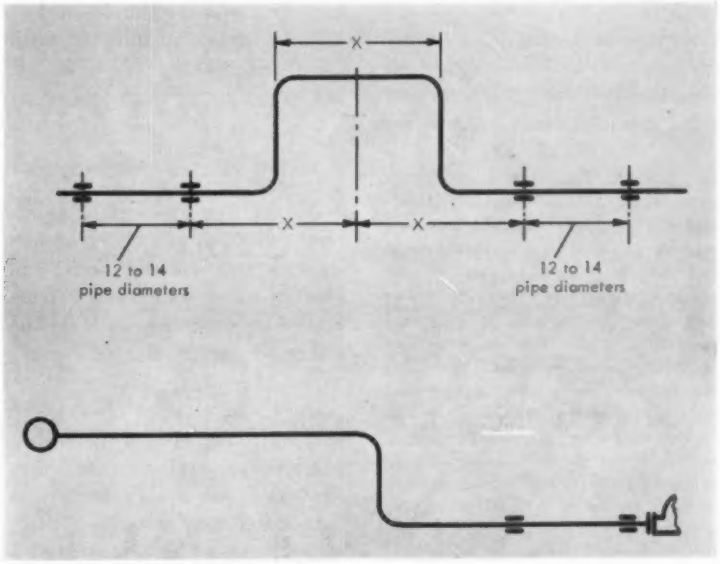
THE BASIC PURPOSE of guides in any piping system is to help define and limit pipe movement. Movement in a pipe line must be as anticipated; that is, in the direction and of such magnitude as has been assumed in making the system design calculations. Unanticipated, or "extra" movements can obviously cause serious consequences.

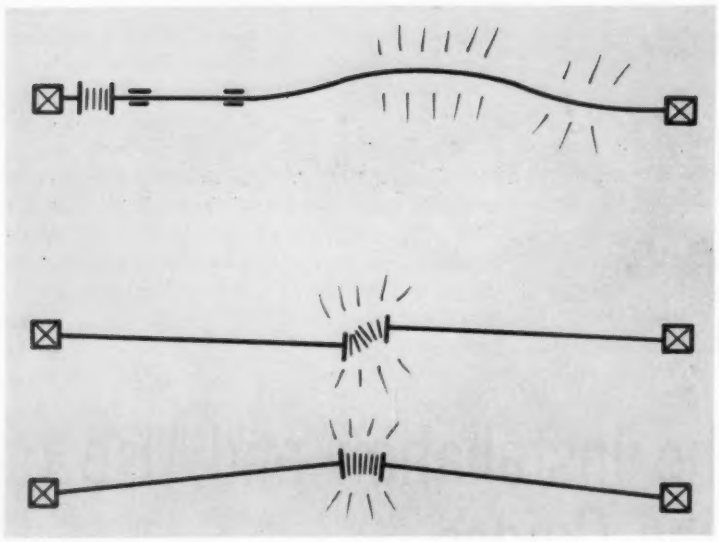
Unfortunately, this simple precept is sometimes completely ignored, or treated more or less as an afterthought. As a result, the wrong element in a system is sometimes blamed for failure or poor performance. This is especially true of piping in which flexibility is provided through the use of loops, bends, or other configurations.

Consider, for example, a simple symmetrical expansion loop as shown in Fig. 1. The installation of guides as indicated in the drawing serves to control the direction of expansive motion, assuring that the line will remain in a specified plane. Yet too frequently a line like this will be supported on rollers or strap hangers without enough guides to direct the thermal expansion.

Fig. 2 is another illustration of the need for proper guiding—a Z-bend configuration between an



1-2 SIMPLE CONFIGURATIONS, symmetrical expansion loop, above, and Z-bend, below, illustrate need for proper guiding to prevent "unanticipated" movements — those not provided for in design calculations



3-4 PIPE GUIDES are needed when bellows expansion joints are used to avoid line buckling, above, or too much lateral offset in the bellows, below

equipment item (say, a pump) and a header. If the casings are cast iron, or if the equipment is otherwise sensitive to the effect of bending moments, the use of two guides near the equipment is indicated.

It is patently clear that pipe guides can be used advantageously in other configurations to protect against overstress in weak spots of the line, and to forestall undesirable displacement of close-tolerance equipment.

Bellows Expansion Joints

When mechanical devices[1] are employed to compensate for axial movement of heated pipe, proper guiding of the line becomes all the more important. As a general rule, these components are designed to accommodate movement in a single plane, and are subject to damage when unanticipated motion exceeds the "safety margin" in the stated operating range.

Margins Are Small

For example, a 3 in., three convolution unreinforced bellows expansion joint will absorb up to 1.22 in. axial movement, but only 0.15 in. lateral offset, unless provision for the secondary movement has been made in the design of the joint. Longitudinal movement of heated pipe therefore must be directed squarely into the bellows expansion joint, if optimum performance is to be expected.

Effect of "Extra" Motion

A pipe line attached to a bellows expansion joint is essentially a structural column with end loading whose stability is a function of its slenderness ratio, or the unbraced length divided by the radius of gyration. Undirected expansive movement should be avoided; otherwise the resultant compressive load on the pipe, combined with a high slenderness ratio, could tend to buckle the line (Fig. 3) or to introduce extraneous lateral offset or angular rotation in the bellows element (Fig. 4).

Either Way — Trouble

In either case, unanticipated forces and stresses can be created which conflict with the basic design assumptions incorporated in the construction of the bellows joint, and thus either condition would adversely affect the performance of that joint.

How Guides Function

A common pipe guide design is one in which a wrought steel spider, which is clamped to the pipe, is inserted in a guide casing which in turn is bolted to a suitable support structure. As the pipe expands or contracts, the spider slides through the casing, permitting movement of the pipe in one direction only (along the axis of the line) and thus insuring proper application of the movement to the bellows expansion joint.

Purpose: Direct, Brace

Such guides serve two purposes. When installed in close proximity to the joint, they hold the pipe in the proper position so as to di-

[1]Slip joints, flexible hose, special fittings and other mechanical elements that are sometimes employed in piping systems are limited somewhat in size and may be subject to pressure/temperature restrictions. They are, therefore, generally employed in individual short pipe runs. Bellows expansion joints are employed with such frequency now that it can be said that their use is at least considered in the design of almost all sizeable piping systems where thermal fluctuations are expected. It is for this reason that the present discussion is centered on the use of pipe guides in conjunction with bellows expansion joints.

TABLE 1 — RECOMMENDED SPACING for pipe guides when used with bellows-type expansion joints

Nominal pipe size, in.	Maximum distance Expansion joint to first guide	First to second guide	Maximum distance[1] between intermediate guides, ft, for pressure (psig) shown below							
	ft in.	ft in.	50	100	150	200	250	300	350	400
3	1 - 0	3 - 6	21	19	17	16	15	14	13	13
4	1 - 4	4 - 8	35	29	25	22	20	19	18	17
6	2 - 0	7 - 0	57	44	37	32	29	27	25	23
8	2 - 8	9 - 4	66	52	45	40	36	33	31	29
10	3 - 4	11 - 8	91	69	58	51	46	42	39	36
12	4 - 0	14 - 0	107	79	66	58	52	48	44	41
14	4 - 8	16 - 4	115	85	71	62	56	51	47	
16	5 - 4	18 - 8	127	94	78	68	61	56	52	
18	6 - 0	21 - 0	139	102	85	74	67	61	56	
20	6 - 8	23 - 4	151	110	91	80	71			
24	8 - 0	28 - 0	172	125	103	89	80			
30	10 - 0	35 - 0	200	144	118	103	92			

[1]Standard weight carbon or stainless steel pipe.

rect movement squarely into the joint, thereby minimizing extraneous movement in the flexible bellows element. Secondly, intermediate guides, located further down the line, help brace the pipe to avoid bowing or bending in the line. Bowing or bending can be caused by end load due to internal pressure and the force required to compress the bellows joint.

How to Space Guides

Good design practice dictates that piping subject to temperature variations shall not be left to float in an indeterminate fashion. Judicious location and spacing of anchors, guides, and supports is therefore of prime importance.

Figure Shows Method

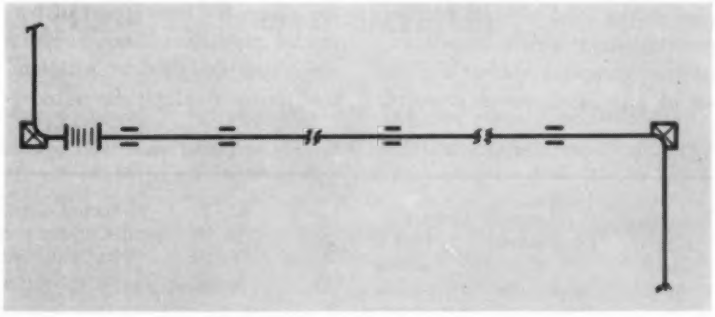
The piping layout of Fig. 5 illustrates some basic principles for correctly anchoring and guiding a pipe line that incorporates a bellows expansion joint for accommodating axial movement.

Use at Least Two Guides

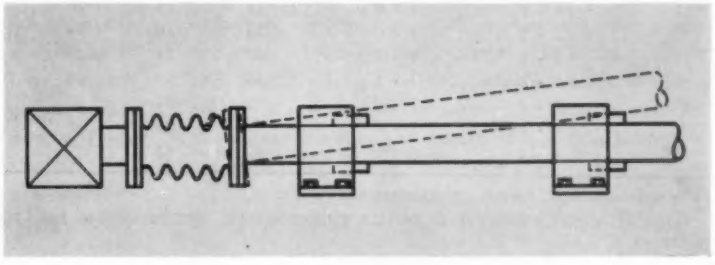
When an anchor is installed adjacent to the bellows expansion joint (this is the preferred anchor location) a minimum of two guides should be used—the first a maximum distance of four pipe diameters from the joint and the second a distance of 12 to 14 diameters from the first. If the anchor cannot be located close to the joint, a minimum of four guides, two on each side of the bellows joint, is required.

Avoid One-Guide Stress

It should be strongly emphasized that the use of a single



5 CORRECT METHOD for anchoring, guiding line containing bellows expansion joint includes at least two guides, may require four



6 SINGLE GUIDE layout should be avoided when bellows expansion joint is involved, to avoid imposition of angular rotation on bellows

TABLE 2 — RECOMMENDED SPACING of pipe guides when used with high pressure expansion compensators

Nominal pipe size, in.	Maximum distance Compensator to first guide	First to second guide	Maximum distance[1] between intermediate guides, ft, for pressure (psig) shown below			
	ft in.	ft in.	50	100	150	175
½	1 - 0	1 - 0	11	9	8	7
¾	1 - 0	1 - 0	14	10	9	8
1	1 - 0	1 - 2	16	12	10	10
1-¼	1 - 0	1 - 6	21	16	14	13
1-½	1 - 0	1 - 9	24	18	15	14
2	1 - 0	2 - 6	30	22	19	17
2-½	1 - 0	3 - 0	38	29	24	22
3	1 - 0	3 - 6	50	36	29	27

[1]Standard weight carbon or stainless steel pipe.

guide is to be avoided, for such a guide may act as a fulcrum to impose angular rotation on the bellows. Fig. 6 illustrates clearly why this is so.

The recommended spacing for guides used in conjunction with bellows expansion joints is presented in Table 1.

Expansion Compensators

Much of what has been said above with reference to bellows expansion joints is equally applicable to expansion compensators, for these are essentially small-outside diameter bellows expansion joints made with a great number of convolutions. Tables 2 and 3 give recommended spacings for pipe guides used in high and low pressure lines which include expansion compensators, on the basis of pipe size, system pressure, and material.

Some high pressure compensators provide internal guiding, and when these are used, the first guide as described above may be omitted. In addition, when low pressure compensators are used between baseboard type radiant elements or for similar services on uninsulated pipe, the usual practice is to clamp the compensator to the wall; in such instances there is usually no need to install other guides as such, since adequate control will be provided already.

Proper Line Support

Additional supports are usually required between the intermediate guides for the support of horizontal pipe lines. Such supports should be designed to withstand the thrust resulting from movement of the pipe over the supports, as well as to carry the dead weight of the pipe, insulation, and contained fluid. Also, it should be emphasized that supports are not satisfactory substitutes for pipe guides, as they cannot provide the concentric restraint required for proper guiding.

Include Guides In Design

Competent analysis of thermal effects in piping is of limited value unless it is paralleled by intelligent guide design and use. Injudicious or inadequate guiding can create an overload hazard instead of providing protection for a line or for sensitive equipment. Proper guiding must be provided for from the first design stages, with actual guide locations considered in the early layout plans. ⧺

TABLE 3 — RECOMMENDED SPACING of pipe guides when used with low pressure expansion compensators

Nominal pipe size, in.	Maximum distance Compensator to first guide	First to second guide	Maximum distance between intermediate guides, ft, for pressure (psig) shown below						
			Steel pipe[1]			Actual OD, in.	Copper water tube[2]		
	ft in.	ft in.	25	50	70		25	50	70
½	1 - 0	1 - 0	16	13	10	0.625	5	4	3
¾	1 - 0	1 - 0	21	16	14	0.875	7	6	5
1	1 - 0	1 - 2	27	21	18	1.125	9	8	6
1¼	1 - 0	1 - 6	39	30	26	1.625	14	11	9
1½	1 - 0	1 - 9	39	30	26	1.625	14	11	9
2	1 - 0	2 - 6	47	35	31	2.125	19	14	12
2½	1 - 0	3 - 0	60	45	39	2.625	23	17	15

[1]Standard weight carbon or stainless steel pipe.

[2]Type M copper tubing. A 10 percent greater spacing may be allowed for Type L tubing and a 20 percent greater spacing for Type K tubing.

The ultimate in design problems?

Air Conditioning a Foundry

THE AIR CONDITIONING problems represented by a proposal to maintain comfortable working conditions in a foundry must rank as one of the most difficult of industrial applications. Yet foundry operations are of critical importance in many plants, and shutdowns due to extreme weather conditions which make work in such spaces unbearable can spread delay and inefficiency throughout a whole manufacturing operation.

The Leslie Co. avoids such problems by the expedient of supplying conditioned air to a 6900 sq ft foundry area in its Lyndhurst, N.J., plant. Within this space, some 39 employees make patterns and cores, and mold, pour, and clean castings — a pivotal operation for the manufacture of pressure vessels.

Air conditioning of the foundry space involved problems of 1) removing high heat loads generated by the heat-producing operations, 2) preventing air currents from affecting the cooling of castings, 3) maintaining satisfactory temperature during all seasons, plus providing humidification and dehumidification as needed, and 4) the prevention of radical temperature changes on workers moving between stations that were spot cooled and the rest of the foundry.

As can be seen in the photo above, the physical layout of the work area posed additional problems of proper air distribution. Heavy wooden rails along two sides of the space support two overhead cranes and restrict the space available for ducts, besides making it impractical to supply air from above the rail elevation. For this reason, two supply ducts are run along the outside of the building, from which take-off branches pierce the exterior walls and descend to low-level outlets.

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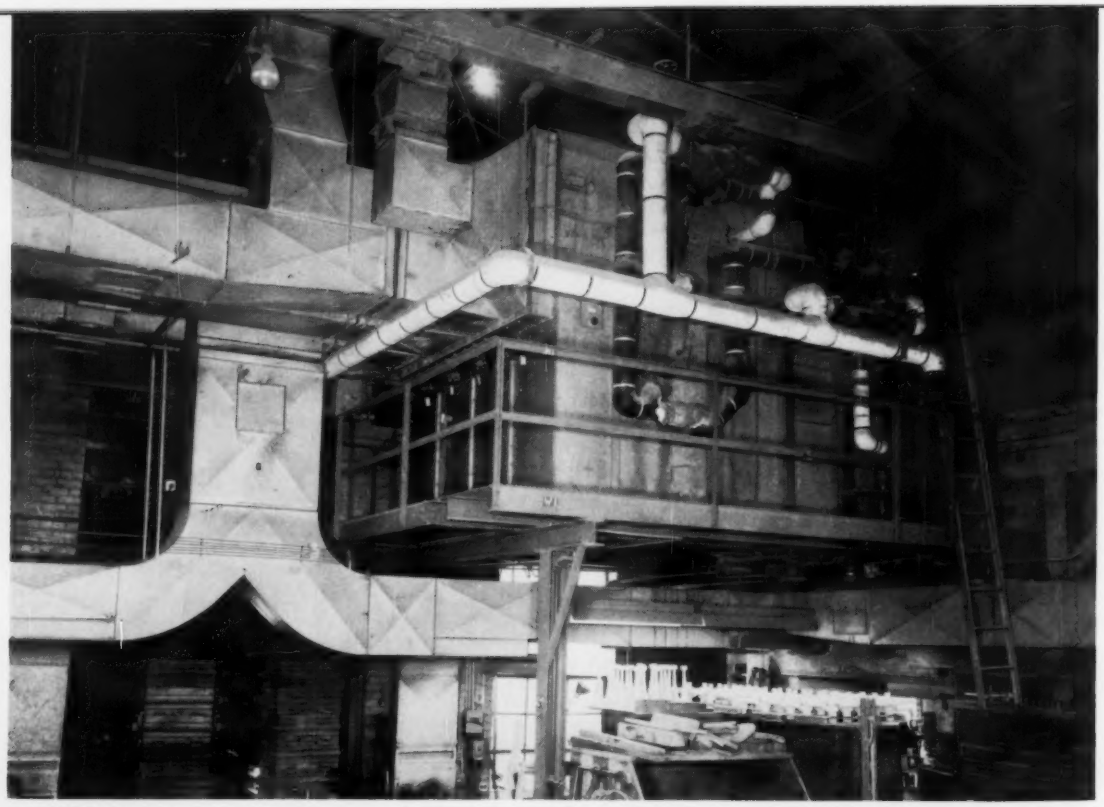
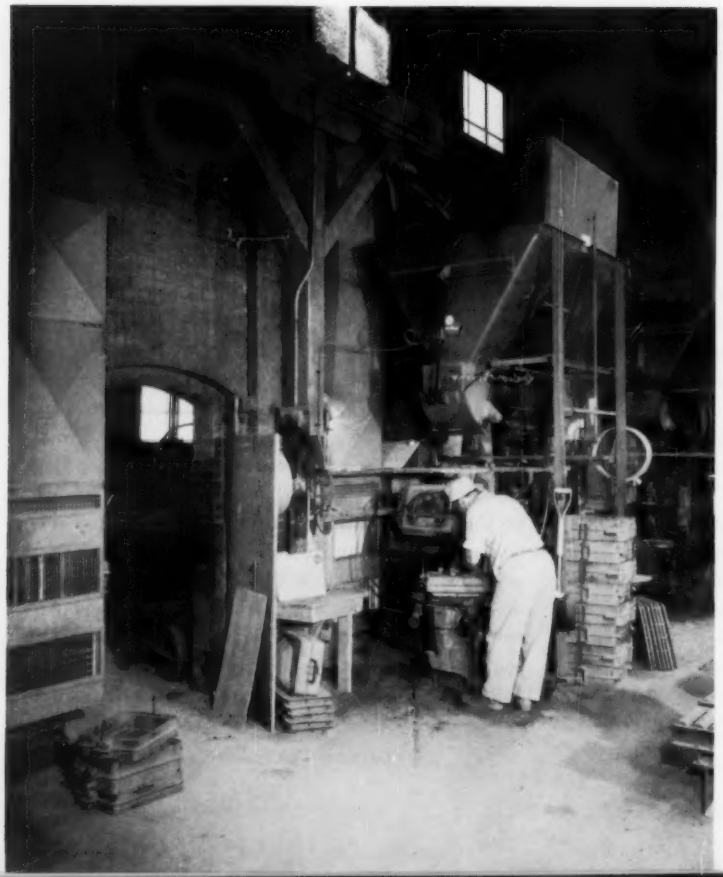


A SINGLE built-up central station unit, located on a raised platform in one corner of the foundry, supplies conditioned air via two supply ducts to the entire area. The unit's capacity is 30,000 cfm, and it is equipped with both preheat and reheat coils using plant steam, plus an eight row cooling coil which is furnished with 200 gpm of well water at 56 F. Cooling capacity of the unit is rated at 100 tons. The two main supply ducts, which are installed adjacent to the long sides of the rectangular building, are suspended outside the exterior walls. Takeoff branches are then brought back through the walls to position outlets as needed.



AIR SUPPLY throughout the foundry is by means of low-level outlets, several of which are visible in the photo at left. Since some of the ducts terminate close to where employees normally work, three separate outlets of various sizes are installed at the end of each branch duct. By this means, the required volume of air is delivered at the proper space intervals throughout the foundry, while at the same time cold drafts due to excess air velocity are largely avoided. Directional louvers on the two largest outlets on each duct permit the air flow to be controlled as needed for best results. Supply ducts pierce wall behind wooden crane rail.

THE SHAKEOUT room section of the foundry is equipped with 20 outlets located in the sides of an overhead duct, as seen at right. One of the principal problems was the need for large quantities of makeup air so that smoke and fumes from the various operations could be exhausted. The system utilizes 100 percent outside air with no recirculation. All air is exhausted through roof outlets, and this plan, together with the introduction of conditioned air at a generally low level, serves to carry contaminated air up and away from work stations. Uniform atmospheric conditions also serve to maintain a constant evaporation rate in removing moisture from mold sand. Formerly, sand tended to dry too quickly or not at all, but since completion of the air conditioning system, the more dependable drying rate has resulted in a decrease in the rejection of finished pieces.

INSPECTION of the plant's finished products is carried on at this steam test station. Like many other areas of the plant, including offices, drafting rooms, and a machine shop, this space is equipped with an individual packaged air conditioner. Air is delivered to each station via overhead diffusers visible in the photo. In the main foundry area, design conditions provide for a temperature of 77 F dry bulb and 60 percent relative humidity when outside temperatures are 95 F DB and 75 F WB. Results of the air conditioning project are reported as "gratifying."

Photos courtesy Carrier Corp.

How to Calculate Friction Factor and For Non-Standard

By VINCENT J. TURECAMO
Consulting Engineer

AIR FRICTION charts in common use for air distribution system problems are based on the flow of "standard air" — dry air at a temperature of 70 F.

This article will serve to facilitate the calculation of the friction factor and density for the flow of non-standard air; that is to say, air of a density less than 0.075 lb per cu ft and at a temperature higher than 70 F.

Friction Factor Is Complex

In spite of its apparent simplicity, the well known formula for head loss

$$H = f(L/D)\ (V^2/2g)$$

where

H = head, in ft of fluid flowing
f = friction factor
L = length of duct, ft
D = diameter of duct, ft
V = velocity, ft per second
g = acceleration due to gravity, 32.2 ft/second/second

is difficult to use. The friction factor, f, which appears as a simple constant, is in fact a complex variable.

To obtain the friction factor, it is necessary to know the value of Reynold's Number, which can be found only if the density, viscosity, velocity, and duct diameter are known, to say nothing of the roughness factor.

To solve for head loss, therefore, it becomes necessary to stumble through a labyrinth of variables.

Offers More Practical Method

However, it may be truly stated that for all practical purposes, the friction factor is a function of the flow rate for a given temperature and roughness factor. Fig. 1 illustrates this proposition, and from this figure, it is possible to obtain the friction factor at once when the temperature and flow rate are known.

Consider the known formula for the friction factor:

$$f = 0.6055\ [1 + [20{,}000(e/D) + 10^6/N_R]^{1/2}]$$

where

e = roughness factor
N_R = Reynolds number

Let us obtain the average deviation of the mean and the percentage of deviation, in order to determine to what extent the friction factor varies within

Density Air Flow

the range of velocity and flow rate encountered in common practice.

Variation Will Be Small

If we take the value of e to be 0.0055 for galvanized iron and express the diameter of the duct in in., the above formula then becomes:

$$f = 0.0055\,[1 + (120/d + 10^6/N_R)^{1/3}]$$

Now if we assume a constant air flow rate of, say 1000 cfm, and vary the velocity from 250 to 3000 fpm (as encountered in common practice), we will obtain the values as shown in Table 1.

The diameter in Table 1 is obtained from the formula:

$$d = 13.54\sqrt{Q/v}$$

where

d = diameter, in.
Q = air flow rate, cfm
v = velocity, fpm

This obtains because

$$Q = v(\text{Area}) = v\pi d^2\ 144(4)$$
$$= vd^2/184$$

The Reynolds Number value in the table is obtained from

$$N_R = VD/v$$

where

v = kinematic viscosity, sq ft per second, for standard air
$= 1.62 \times 10^{-4}$

therefore

$$N_R = 8.55vd$$

This is the correct value, in other words, for standard air at 70 F with a kinematic viscosity of 1.62×10^{-4} sq ft per second.

Taking the above values for the friction factor, we can determine the percentage deviation from the mean as follows:

	f	Deviation
	0.0208	0.00074
	0.0200	0.00006
	0.0198	0.00026
	0.0197	0.00036
	0.0198	0.00026
	0.0199	0.00016
	0.0200	0.00006
	0.0202	0.00014
	0.0203	0.00024
Sum	0.1805	0.00228
Average	0.02006	0.000253

Therefore, the average deviation from the mean will be

$$A.D. = 0.000253/\sqrt{9} = 0.000084$$

and the percentage deviation from the mean will be

$$P.D. = (0.000084/0.02006)100 = 0.40$$
$$= 40 \text{ percent}$$

Since, therefore, the value of the friction factor varies by no more than $\pm$ 0.000084, or $\pm$ 40 percent deviation from the mean, then for all

TABLE 1 — CONSTANT AIR FLOW RATE with velocities varying from 250 to 3000 fpm produces varying friction factor as shown below

cfm	Velocity fpm	Diameter in.	Reynolds Number	Fricton Factor (f)
1000	250	27.08	57,900	0.0208
1000	500	19.15	82,000	0.0200
1000	1000	13.54	115,770	0.0198
1000	1200	12.36	124,410	0.0197
1000	1400	11.44	136,940	0.0198
1000	1600	10.70	146,380	0.0199
1000	2000	9.57	163,650	0.0200
1000	2500	8.56	182,980	0.0202
1000	3000	7.82	199,480	0.0203

non-standard air friction, density

practical purposes we may conclude that for a given temperature and roughness factor, the friction factor is a function of the air flow rate.

Further confirmation of this can be seen from the family of curves in Fig. 1.

Rate of Increase Varies

It should be noted that in the lower range of air flow, the friction factor increases more rapidly with temperature than in the higher range. For example, for 100 cfm the factor increases from 0.0265 to 0.0328 as the temperature rises from 70 to 600 F — a 24 percent increase — while for 100,000 cfm the increase is only about 12 percent for the same rise in temperature.

Also noteworthy is the fact that if the friction factor remains constant, the air flow rate will increase with temperature. For example, for a constant friction factor of 0.020, and with an increase in temperature from 70 F up to 600 F, the air flow rate will increase from 860 cfm to 4000 cfm, as seen in Fig. 1.

The Density-Friction Factor

The basic flow equation, expressed in terms of head loss per 100 ft, density, diameter, and air flow rate, is

$$h = (f\rho)\ (33.6)\ (Q^2/d^5)$$

where

h = head loss in in. WG per 100 ft
ρ = fluid density, lb per cu ft

For the sake of convenience, the value $f\rho$ may be called the "density-friction factor," (k).

Then the equation simplified becomes

$$h = k(33.6)\ (Q^2/d^5)$$

This is a workable equation which for a given air flow rate and head loss is reduced to but one unknown quantity, assuming the density-friction factor, k, is known.

Since the friction factor, f, is immediately obtained from the family of curves in Fig. 1, we have now only to obtain the density with equal simplicity in order to complete the picture.

Fig. 2 gives the density of air for any condition from the dry to the saturated state at temperatures up to 212 F. The relative humidity curves are drawn from the following relationship:

$$\rho_m = \rho_d(1 - \phi) + p_s$$

where

ρ_m = density of mixture of dry and saturated air, in lb per cu ft, for a given temperature
ρ_d = density of dry air, lb per cu ft
ϕ = relative humidity, percent
p_s = density of saturated air, lb per cu ft

Here the density of a mixture of dry and saturated air is expressed in terms of relative humidity for air with a barometric pressure of 29.92 in. of mercury. The curve for dry air in Fig. 2 is obtained from the equation

$$PV = WRT$$

where

P = absolute pressure in lb per sq ft = 14.7×144
V = volume in cu ft = 1
W = weight of gas in lb
R = gas constant for 1 lb of gas = 53.34
T = absolute pressure

so that

$$W = 39.7/T$$

From this it appears, of course, that the density of dry air varies inversely as the absolute temperature. The curve for saturated air in Fig. 2 gives the weight per cu ft of a saturated mixture of dry air and vapor for given temperatures.

For example, air at 140 F and 30 percent relative humidity has a mixture density of 70 percent dry air and 30 percent saturated air, or

$$\rho_m = [b - \epsilon\phi\ (1 - s)] \ / \ [346.5 + 0.7535t]$$

where

b = barometric pressure in in. of Hg (29.92 standard)
ϵ = vapor pressure of water in in. of Hg
s = specific weight of water vapor compared with air at the same temperature as unity
t = temperature, F

If it is desired to use the general equation for the density of a mixture, then

$$\rho_m = (0.06614)\ (0.70) + (0.06132)\ (0.30)$$
$$= 0.006469 \text{ lb per cu ft}$$

If we take the specific weight of the vapor compared with air to be

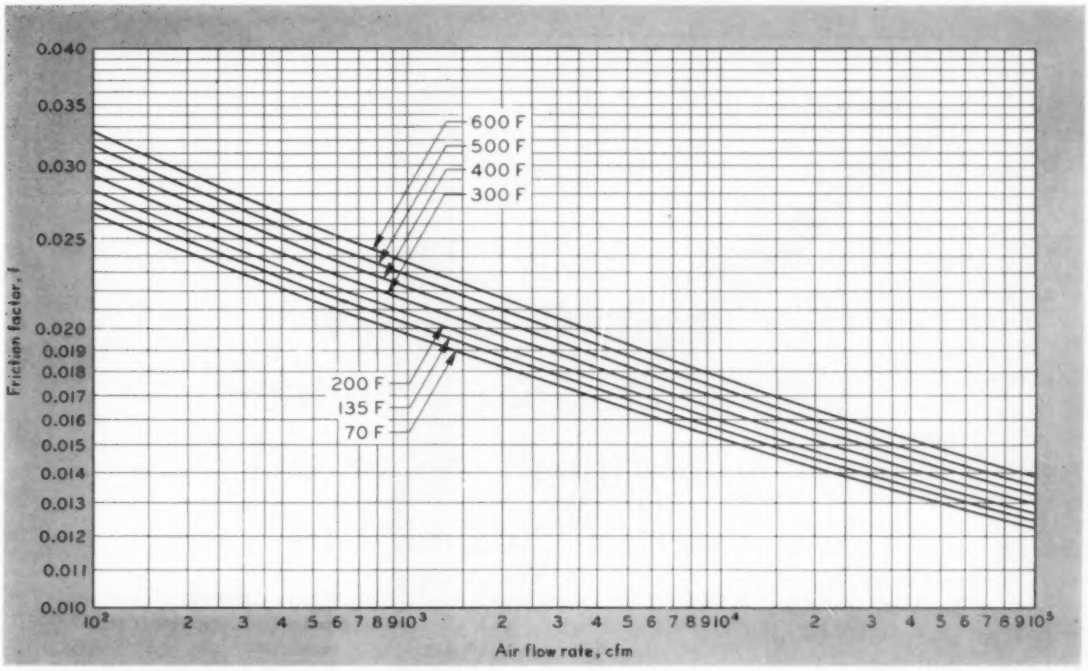
$$s = 0.625$$

then

$$\rho_m = [29.92 - (5.881)\ (0.30)\ (0.375)] \ / \ [346.5 + 0.7535\ (140)]$$
$$= (29.92 - 0.66)/(346.5 + 105.49)$$
$$= 29.26/452 = 0.0647 \text{ lb per cu ft}$$

Density Ratio

It is important to note that the density ratio obtained by use of absolute temperatures is correct only for dry air. If the density is changed by relative humidity, then a ratio of the actual densities must be used.



1 FRICTION FACTOR for air flow when air flow rate (cfm) is known

For example, the ratio of dry air at 70 F to dry air at 200 F is

$$R = (t_1 + 460)/(t_2 + 460)$$
$$= (70 + 460)/(200 + 460)$$
$$= 530/660 = 0.805$$

when

R = density ratio
$= t_1/t_2$ (dry air)
$= \rho_2/\rho_1$ (mixed air)

The same ratio is obtained, of course, with the inverse of dry air densities, or

$$R = 0.06018/0.07495 = 0.805$$

Now if the relative humidity for air at 200 F is increased to 50 percent, then from Fig. 2 the density becomes 0.0515 lb per cu ft, so that the ratio is changed as follows:

$$R = 0.0505/0.07495 = 0.686$$

The effect of higher temperature and relative humidity upon head loss and air flow rate can be illustrated by the following examples.

Example 1

For standard air the head loss in a system is 0.50 in. WG. Find the head loss if the temperature increases to 200 F and 30 percent relative humidity.

Solution. Obtaining the proper values from Figs. 1 and 2, the density-friction factor ratio becomes

$$R = (0.0208)\ (0.055)/(0.0197)\ (0.75)$$
$$= 0.774$$

Hence, the new head loss becomes

$$h_2 = 0.774\ (0.50)$$
$$= 0.387$$

If the friction factor is ignored, the density ratio is

$$R = 0.055/0.075 = 0.746$$

and

$$h_2 = 0.746\ (0.50) = 0.373$$

If the relative humidity is ignored, then

$$R = 0.0602/0.075 = 0.80$$

and

$$h_2 = 0.80\ (0.50) = 0.40$$

Now if the system were designed for a head loss of 0.387 in. WG for air at 200 F and 30 percent relative humidity, with a flow rate of 10,000 cfm, then the same system would produce less cfm if operating with standard air:

$$Q_s = \sqrt{R} \times 10{,}000$$
$$= 0.774 \times 10{,}000$$
$$= 0.88 \times 10{,}000$$
$$= 8800 \text{ cfm}$$

Example 2

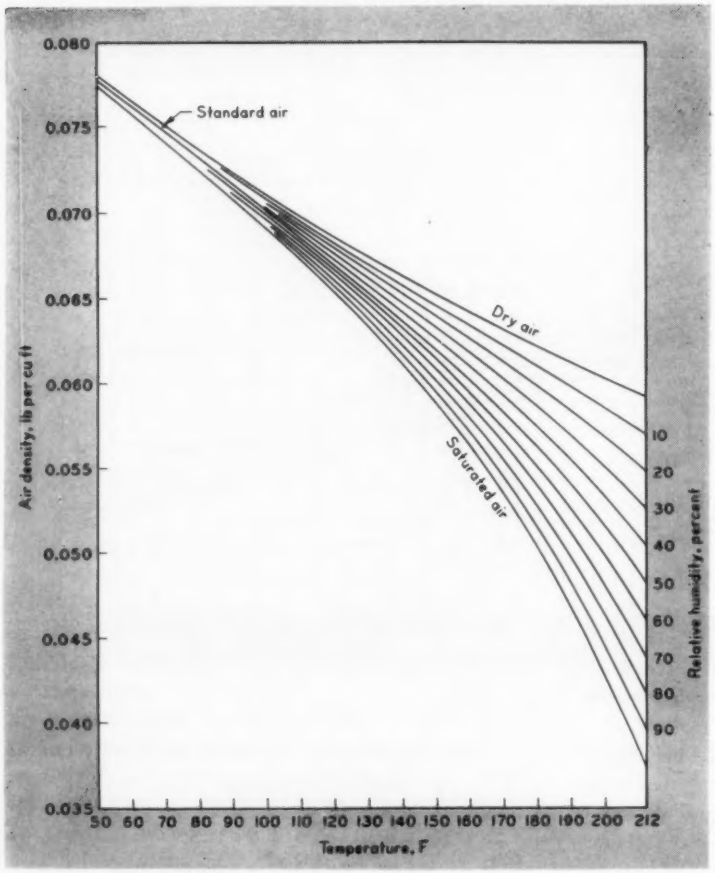
A blower with a volume of 10,000 cfm must deliver air at 200 F and 50 percent relative humidity. The static pressure, determined on the basis of standard air, is 1.25 in. WG, and the motor hp selected for standard air is 2.78. Find the actual static pressure for air at 200 F and 30 percent RH, and find the actual hp required.

Solution. The density-friction factor ratio is

$$R = [(0.0208)\ (0.0515)]/[(0.0197)\ (0.075)]$$
$$= 0.00107/0.001478 = 0.72$$

Therefore, the actual static pressure is

$$1.25 \times 0.72 = 0.90 \text{ in. WG}$$



2 AIR DENSITY for any state (dry to saturated) at temperatures up to 212 F. This is second of two factors needed to solve for head loss, can be read directly from curves at left

And the actual hp is

$$2.78 \times 0.72 = 2 \text{ hp}$$

Hence, the blower will deliver 10,000 cfm at 200 F and 50 percent RH, against a static pressure of 0.90 in. WG, with a 2 hp motor.

Example 3

A boiler with a firing rate of 100 gal per hr has an induced draft fan discharging into a metal stack. Assume the required combustion air to be 80 cfm per gal per hr, and the density of the air to be 0.04 lb per cu ft. Find the flow rate at 70 F and at a stack temperature of 600 F.

At stack temperature the required flow rate is

$$80 \times 100 = 8000 \text{ cfm}$$

To find the flow rate at 70 F (during the prepurge period) we first obtain the density-friction factor ratio as follows:

$$R = (0.0245)\ (0.04)/(0.0202)\ (0.075)$$
$$= 0.645$$

Then the cfm at 70 F is

$$Q_s = \sqrt{R}\ (Q_s) = 0.645\ (8000)$$
$$= 0.80\ (8000)$$
$$= 6400 \text{ cfm at } 70 \text{ F}$$

Note that the fan rpm and hp can be selected on the basis of standard air at 6400 cfm, with head loss also based on standard air. An alternate method of selecting the fan is to assume the same cfm and rpm for both standard and non-standard air, but in this case both the head loss and hp would be proportional to air density. The rpm would be obtained for standard air against the higher head loss, while the actual hp would be obtained by multiplying the hp for standard air by the density ratio.

Example 4

30,000 cfm of air passes through a dryer at 120 F and 20 percent RH, and leaves the dryer at 200 F and 40 percent RH. Find the density in lb per cu ft of the entering and leaving air, and determine the flow rate of the leaving air.

From Fig. 2, the density of the entering air is 0.068 lb per cu ft, and the density of the leaving air is 0.053 lb per cu ft. Assuming the flow in lb per minute to be constant, then

$$30{,}000\ (0.068) = Q_2(0.053)$$
$$Q_2 = 30{,}000\ (0.068/0.053)$$
$$= 38{,}500 \text{ cfm}$$

National District Heating Association Discloses Progress And Future Plans

By JOHN F. COLLINS, JR.
Secretary Treasurer, NDHA

NDHA recently held in Portsmouth, N. H. a very successful 52nd annual meeting; made so especially by excellent attendance; by interesting breakfast and technical sessions and committee meetings; and by the availability of a generous supply of technical paper preprints.

Almost 40 percent of the total personal association membership was on hand — more than had attended any similar gathering in the last two decades. The activity of NDHA's New England section in this connection was very fruitful.

The association now holds three-day meetings instead of four, but on the day preceding the first general meeting, the technical committees get together to consider their reports and papers and especially to plan, while most all are on hand, the research to be undertaken during the year to follow.

This year seven committees held meetings. At eight breakfast sessions members discussed informally their problems with others in similar activities. The Campus Heating group considered its somewhat different interests.

Finally, at five three-hour technical sessions, the officers reported, the technical committee chairmen introduced their authors, and the latter presented the results of their research.

President's Remarks

In his address opening the first general meeting, President Albert F. Metzger of Pittsburgh said that the association was in good financial condition, even though increased prices made it more difficult to operate as in the past.

He said that among the unusual activities being carried on were (1) the rewriting of the "Principles of Economical Heating" by the educational committee, chairmaned by Leo F. Collins, general superintendent of central heating, The Detroit Edison Company, preparatory to the printing of the sixth edition; (2) the completion of new and improved Unwin's charts and supplementary rules for determining pressure loss in steam lines by Carl W. Signor of the same committee and company; and (3) the preparation of a new general index of papers and reports issued in the last 17 years, about to be undertaken by NDHA Headquarters.

Secretary Reports Progress

The association secretary-treasurer and chairman of the publication committee, John F. Collins, Jr. of Pittsburgh, made a more detailed report of NDHA activities. He said that the association, through the work of its new advertising committee, headed by Fred W. Deutsch, in charge of national accounts sales for B-I-F Industries of Providence, R. I., had secured a substantial increase of advertising in the association's house organ.

An unusual number of deaths and other losses resulted in the association membership total remaining substantially the same in 1960 according to the report of the membership chairman, Henry W. Angelery, president of Aerco Corp., Northvale, N. J.

New members in the 536 total at the year's end included three new steam utilities, five new manufacturers, three other organizations and 21 individuals.

Steam Rates Stationary

Reporting on steam rates in 80 communities, chairman of the NDHA rates and regulations committee, Clifford O. Thurlow, rate consultant for Commonwealth Services, Inc., Jackson, Mich., said that during 1960 there had been only six basic steam rate increases and only one decrease.

Five of the increases were nominal, ranging from as low as 1.0 percent to about 10 percent. The sixth increase was 25 percent.

The one decrease amounted to 3.5 percent on steam sales during the heating season and to about 15 percent on sales during the other months.

Service was discontinued in Atlantic City, N.J. and Danville, Ill.

The basic figures on the district heating industry's growth were re-

NDHA 1961-62 Executive Board

SEATED, *l to r,* First Vice President James C. Thompson, Atlanta; President John D. Lemon, Indianapolis; Past President Albert F. Metzger, Pittsburgh; Second Vice President Frank C. Meyer, Boston. STANDING, *l to r,* Third Vice president Robert H. Swoyer, Allentown; Director James W. Heaton, Philadelphia; Director Henry T. Kucera, Sellersville, Pa. THIRD ROW, *l to r,* Secretary-Treasurer John F. Collins, Jr., Pittsburgh; Director E. C. Bruce, New York; Director Carl W. Signor, Detroit. Directors Homer A. Lawrence, Cleveland, and Lloyd W. Denison, Philadelphia, were absent when photo was taken

ported as usual by the committee chairman, Foster L. Stephens, steam heating engineer of the Allegheny County Steam Heating Co. in Pittsburgh. Mr. Stephens had figures for 55 steam properties. He reported that in 1960 total steam sales were 3.3 percent greater than in 1959 as might be expected, since the degree-day total was 3.2 percent greater, being also 3.2 percent above normal. Although heated volume increased 1.2 percent, connected equivalent direct radiation remained as in the previous year.

The gross revenue per M lb sold increased 1.0 percent, which probably was the result of the rate increases because the Btu cost of the fuel decreased 1.5 percent. By itself this would result in a lesser revenue.

Improved distribution seems evident because while pipe radiation surface increased 0.5 percent, the percentage of steam loss remained as before.

An increase of 0.9 percent in generating capacity and of 0.3 percent in steam main length resulted in a capital investment increase of 1.8 percent. Load factor increased about one percent.

The actual sendout on the maximum hour was 25 percent under the reported maximum hourly steam generating capacity at 1 F.

The largest company, based on steam sales, sold 19,704,269 M lb. The second largest sold 5,191,654 M lb. The latter company, in Philadelphia, reached this position for the first time.

Sales Improvements

Further information on sales was reported by William C. Kaber, industrial engineer of the Union Electric Company, St. Louis, member of the NDHA sales development committee. Mr. Kaber said that in 33 cities of 44 reporting to him, 278 new steam customers had been connected in 1960. These, it was estimated, would require 2,702,886 M lb of steam and bring the utilities an additional revenue of $3,670,000 annually or $1.36 per M lb, compared with $1.17 in 1959.

A breakdown of the new customers shows eight percent had taken steam at some previous time, 44 percent were in old buildings being served for the first time and 48 percent were in new structures. Ninety-five existing customers in 12 cities added load, increasing the revenue by an estimated $423,730 or 11.5 percent.

The report also showed 41 customers were lost in 10 cities, decreasing estimated revenue by $449,871. Forty-nine percent of those lost converted their systems to the use of gas.

In three cities it was reported that the boiler capacity is inadequate to serve more customers and in only one of these are additions being considered. Only a limited amount of spare capacity is available in 11 localities.

In two cities steam capacity was increased 550,000 lb per hr — a lesser figure than that for 1959, but in turn less than that expected in 1961. In 30 cities, boiler capacity is reported as adequate.

Similarly, distribution facilities are limited in 12 cities and are adequate in 32. In 12 locations additional lines were provided in 1960 and in the same number of cities additions and replacements are planned for 1961. About five miles of pipe is installed each year.

Elect Officers

At the close of the 52nd annual meeting, John D. Lemon, assistant treasurer, Indianapolis Power & Light Co., was inducted into the presidency of NDHA, succeeding Albert F. Metzger of Pittsburgh. James C. Thompson, manager of appliance sales, Georgia Power Co., Atlanta, Ga., was elected first vice-president; Frank C. Meyer, head of the steam sales division, Boston Edison Co., was chosen sec-

ond vice-president; and Robert H. Swoyer, mechanical research engineer, Pennsylvania Power and Light Co., Allentown, Pa., was named third vice-president.

Three new directors of the association were elected for two yr terms. They are E. C. Bruce, manager, steam sales bureau, Consolidated Edison Co. of New York, Inc.; Henry T. Kucera, general manager, Automatic Devices Division, American Machine and Metals, Inc., Sellersville, Pa.; and Carl W. Signor, supervisor, technical staff, central heating department, The Detroit Edison Co., Detroit, Mich. Four others remain on the Board. They are past president Albert F. Metzger, supervisor, steam utilization, Allegheny County Steam Heating Co., Pittsburgh, Pa.; John F. Collins, Jr., NDHA secretary-treasurer; James W. Heaton, assistant manager, industrial sales division, Philadelphia Electric Co., and Homer A. Lawrence, commercial sales manager, The Cleveland Electric Illuminating Co.

At the same gathering the Executive Board of NDHA filled a vacancy in its membership by electing Lloyd W. Denison, manager, boiler trim sales, Yarnall-Waring Co., Philadelphia, Pa., to fill the seat formerly held by Andrew M. Ritter, district manager of the same organization in Chicago.

The Greenbrier at White Sulphur Springs, W. Va. will be the site of the next annual meeting of NDHA on June 27, 28 and 29, 1962.

Reports of technical papers presented at the 1961 meeting will appear in future issues. ∓

Electronic Air Cleaners Cut Maintenance Costs at Department Store

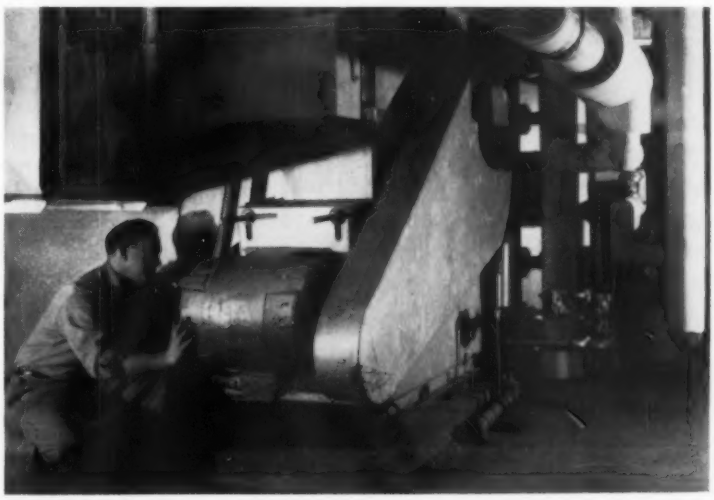
MERCHANDISE soilage from airborne dust and dirt is a critical problem in retail department stores. To solve this problem, a department store in Pittsburgh recently installed an electronic air cleaning system and effected a double benefit: the dust and dirt were removed and so was the need to cover the merchandise with drop cloths for protection.

The Joseph Horne Co. department store is heated and cooled by chilled water and steam coils, according to the Westinghouse Electric Corp. The system uses one multizone air handling unit rated at 16,600 cfm and six others with a total capacity of 160,000 cfm. The units are arranged in four in-line systems in an equipment room located on the upper level of the store. Each air handling system consists of a matching in-line air cleaner, heating and cooling coils, and fans. Two 34,000 cfm air cleaners serve the second floor sales area of the store; three units with 28,000 cfm capacities serve the main floor sales area; and two air cleaners with capacities of 16,600 and 7200 cfm serve selling offices, beauty shop, and patio shop.

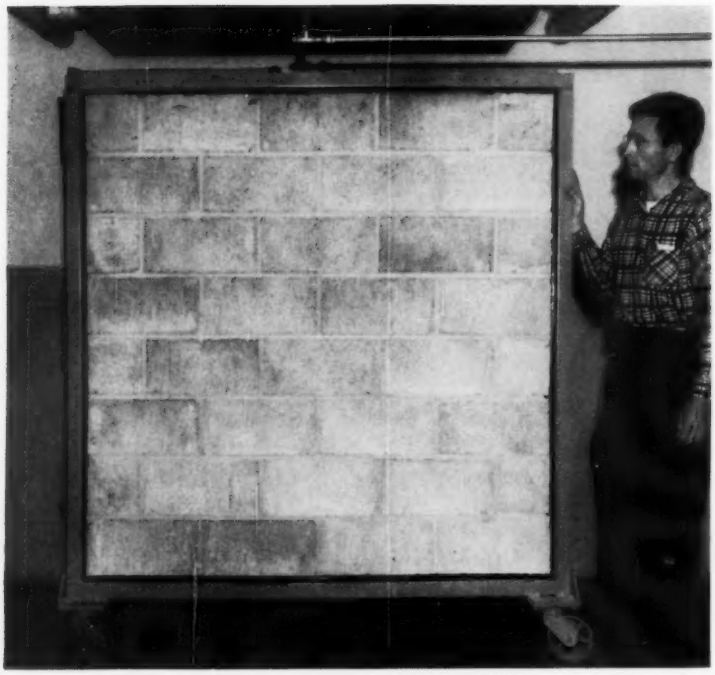
The equipment room on the upper level serves as the main plenum chamber for the ventilating system and supplies air to the equipment. A space above the ceiling in the store's main sales area serves as a return air duct with return air registers located at various points in the ceiling of the store.

All controls for the ventilating, cooling, heating, and air cleaning systems are on one centrally located panel adjacent to the equipment room. This panel includes controls for the exhaust fans, all the air conditioning units, all electronic air cleaners and their washing controls, air conditioning compressors, pumps and boilers. Indicating lamps on the panel are used to show which units are operating, and the various stages of the operating cycle as they occur.

John Mullin Associates of Pittsburgh was the consulting engineering firm. ∓



IN-LINE ventilating unit in Horne's Department Store has two-speed fan motor to allow half-speed operation at night



1 TEST PANEL, 28 sq ft in size, constitutes one of nine types of wall construction investigated

Tests Reveal Moisture Migration Rates Through Variously-Constructed Walls

By R. J. ZABLODIL
Director, Environmental Control Division,
U.S. Naval Civil Engineering Laboratory, Port Hueneme, Calif.

Investigations aimed at producing better designs for military stores warehouses — thereby reducing the loads on dehumidifying equipment — result in the accumulation of useful data on moisture migration through walls of various common constructions.

MOISTURE, following natural laws, migrates from high to lower partial vapor pressure regions. If a substance impedes the flow, a vapor pressure differential will result; as for instance in the case of dehumidified warehouses, where floors, walls, and roofs constitute the vapor barrier. The vapor pressure outside the warehouse, in the ground and outside air, forces moisture into the dehumidified space of relatively low vapor pressure.

Moisture: A Harmful Agent

This in-flow of moisture increases the possibility of a deterioration of stores, and imposes a heavier load on dehumidifying machinery. (Where the U.S. Navy uses dehumidified storage, it generally keeps the relative humidity in the range of 30 to 50 percent,

which is sufficient to effectively control deterioration and is less costly to maintain than lower relative humidities.)

Test for Various Constructions

Engineers at the Naval Civil Engineering Laboratory in Port Hueneme, California, have measured water vapor transmission rates through various types of wall sections constructed of materials similar to those used in dehumidified warehouse walls. The results of the tests constitute information applicable to a wider range of construction.

Test wall sections were 28 sq ft in size, and were set in steel frames mounted on dolly wheels for convenient movement without damage. Fig. 1 shows one of the test sections.

Use Special Testing Facility

Nine wall sections were tested for a variety of water vapor pressure differentials in a specially-built test facility (Fig. 2). This facility has essentially six areas: a boiler room, equipment room, soaking room to condition test walls so that equilibrium moisture content during tests could be reached more quickly, an instrument and control room, and two test cells where the work with the wall-section panels was carried out and water vapor transmission rates actually determined.

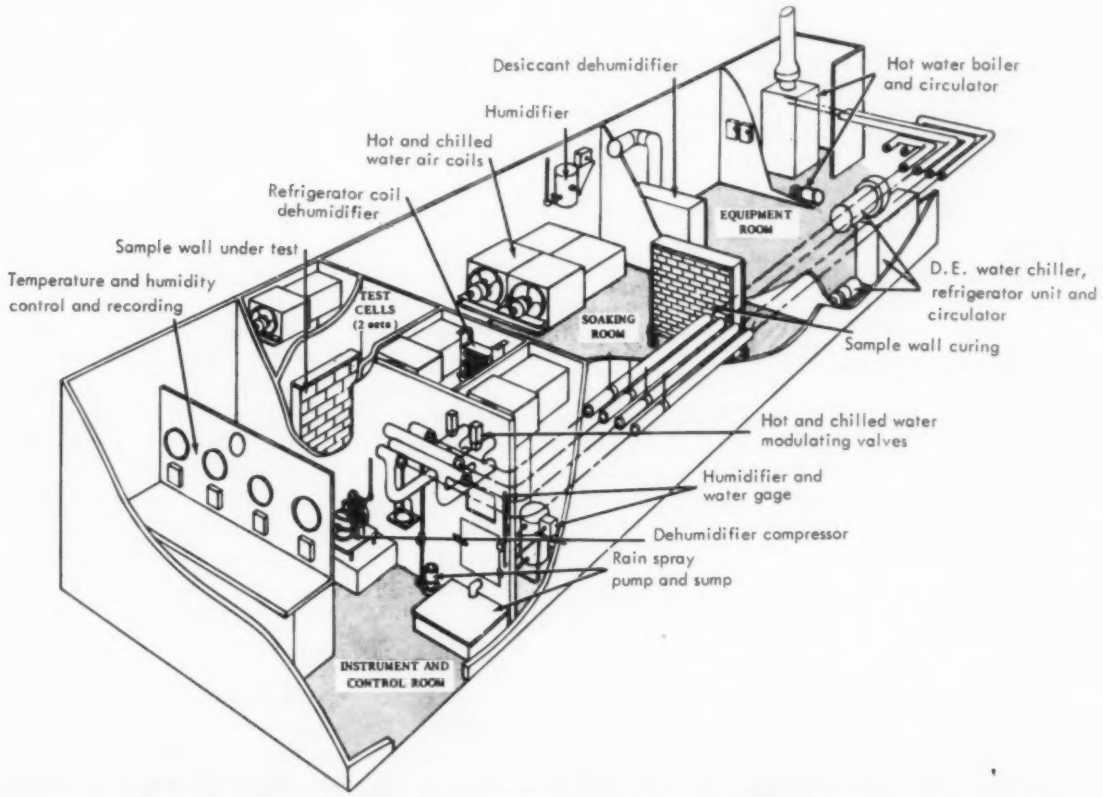
How Cells Operate

The test cells are essentially giant dry cups, wherein the partial vapor pressure on one side of the test wall is higher than on the other side. The dew point temperature was elevated on the high side by water evaporated from a humidifier, and depressed on the low side by a desiccator.

Conventional liquid-to-air heating and cooling coils piped through 3-way motorized valves to a 125,000 Btuh hot water boiler and 5 ton capacity cooling equipment provide the desired dry bulb temperatures. Dew point and DB temperatures are controlled automatically, with control points adjustable from a remote instrument panel.

Change Low-Side Design

Originally, a small cooling coil in the low vapor pressure side of each cell was connected to a ¼ ton capacity Refrigerant 12 compressor to control the dew point temperatures. Using this method, the surface temperature of the coil was held at the desired dew point, and condensate, which represented moisture migrating through the test walls, was collected



2 TEST FACILITY can accommodate all vapor transmission preparation and data gathering activities in total of six areas

TABLE 1 — MOISTURE MIGRATION rates through replicas of various kinds of common-construction walls

Wall No.	Thickness, in.	Wall composition, inside to outside	Temperature, F (both sides)	Relative humidity, percent HVP side*	Relative humidity, percent LVP side*	Pressure diff, in. Hg.	Moisture rate, grains per hr
1	4½	2 by 4 in. wood studs 16 in. on center (OC), ½ in. gypsum sheathing, 30 lb felt building paper, 3/16 in. cement asbestos board siding	65	70.3	29.7	0.25	7.0
			78	75.6	22.5	0.50	14.3
			102	70.0	17.8	1.00	31.0
2	4¾	2 by 4 in. wood studs 16 in. OC, ¾ in. wood sheathing (Douglas fir), 30 lb felt building paper, 3/16 in. cement asbestos siding	65	70.1	29.3	0.25	6.3
			78	76.4	19.8	0.55	17.8
			102	70.5	18.3	1.00	33.6
3	8	Concrete block and mortar	65	70.6	34.0	0.23	6.6
			78	71.5	18.8	0.51	12.6
			102	65.0	15.0	1.03	42.3
4	8	Double 4 in. common brick & mortar	65	73.5	29.7	0.27	7.7
			78	72.5	21.6	0.49	19.6
			102	65.5	21.5	0.90	35.0
5	14	4 in. common brick & mortar, 2 in. cavity, 8 in. concrete block & mortar	65	71.9	32.6	0.24	6.8
			78	70.0	18.3	0.50	17.4
			102	68.4	14.0	1.12	38.7
6	12½	4 in. common brick & mortar, ⅜ in. mortar on brick inner face, 8 in. concrete block & mortar	65	74.4	27.2	0.30	6.6
			78	73.9	22.3	0.50	17.9
			102	63.8	20.1	0.90	33.3
7	12½	4 in. common brick & mortar, ⅜ in. mortar on concrete block inner face, 8 in. concrete block & mortar	65	92.0	47.0	0.28	4.7
			78	71.6	18.2	0.52	21.2
			102	63.0	17.1	0.94	29.5
8	12½	4 in. common brick & mortar, ½ in. slushed-in mortar joint, 8 in. concrete block & mortar	65	69.5	30.0	0.25	5.9
			78	74.4	19.3	0.53	13.4
			102	64.4	16.3	0.99	36.1
9	12	4 in. common brick & mortar, coating of coal tar pitch, 8 in. concrete block & mortar	65	88.2	49.7	0.24	4.2
			78	69.3	20.7	0.47	23.2
			102	67.1	18.0	1.01	41.5

*HVP high vapor pressure; LVP low vapor pressure

and piped to the instrument room, where it was then measured.

This method, however, gave erratic results, and was replaced by the desiccator system.

New Means Stabilize Tests

Steady state was satisfactorily obtained using a desiccator containing silica gel. First, an equilibrium moisture content of the wall was established in the soaking room. Then the wall section was transferred to a test cell, where psychrometric conditions had been previously established.

After the wall was in place and sealed, it was again soaked until final equilibrium moisture content was reached. Refrigerant and a leak detector were meanwhile used to locate any possible faults in the sealing.

The air of the low vapor pressure side was recirculated through the desiccator at a rate which maintained the desired dew point temperature. Thus, the desiccator was absorbing moisture at the same rate at which moisture was passing through the test wall. A manual valve was used to adjust the circulating air rate.

The desiccator, which is easily detachable, was weighed before and after each test on a balance accurate to 0.3 gram. An increase in weight divided by the time duration of the test yielded the transmission rate of vapor through the wall.

Because psychrometric conditions on each side of the wall were held constant, this rate represented a steady state. Each test run continued for about 17½ days during low vapor pressure differential tests. Higher differential tests, during which the desiccator absorbed moisture more quickly, lasted for about 7½ days.

Table Shows Results

Table 1 gives the results of the tests on the nine different wall sections. During all tests, the temperature on each side of the wall sample was maintained constant to prevent condensation from forming on the wall's high vapor pressure side. ∓

Direct-Reading Chart Gives Pressure Losses Through Various Fittings

By JOHN D. CONSTANCE
Professional Engineer

IT IS a simple matter to determine the friction loss of air flow through straight ducts. Such values can be taken directly from standard charts. However, the determination of friction loss through elbows, fittings, hoods, dust traps, etc., is not so easy.

The chart on the following page provides a quick method for finding friction losses for various fittings. For any fitting included on the chart, only the air velocity through the duct (slant lines on chart) need be known. The intersection of the velocity line with the proper velocity head line yields the friction loss directly. No factors are necessary.

The chart is based on an air density of 0.078 lb per cu ft (70 F dry air at atmospheric conditions and 29.92 in. Hg barometric pressure). Usually, corrections are not needed for temperatures under 100 F and elevations of 1500 ft or less. However, where considerable variation from these limits is encountered, the change in air density must be considered.

Effect of Altitude, Temperature

It will be recalled that a centrifugal fan in a given system will handle essentially constant volume, regardless of air density. However, the *weight* of the air moved will vary with air density, as will the pressure developed and the hp required.

For example, suppose a fan in a given system is able to handle 10,000 cfm of air at standard conditions (0.078 lb per cu ft). If the air is heated upstream of the fan inlet to a temperature of 600 F, the fan will handle 10,000 cfm at 600 F. The volume of air handled under these conditions reduces to 5000 cfm at standard conditions, and would reduce the rate of flow entering the system — say through a hood.

Now if the hood design called for 10,000 cfm at room temperature (70 F), the actual volume would be 5000 cfm, and the hood would therefore be less effective. Likewise, air density at 5500 ft altitude reduces to 80 percent of standard condition weight.

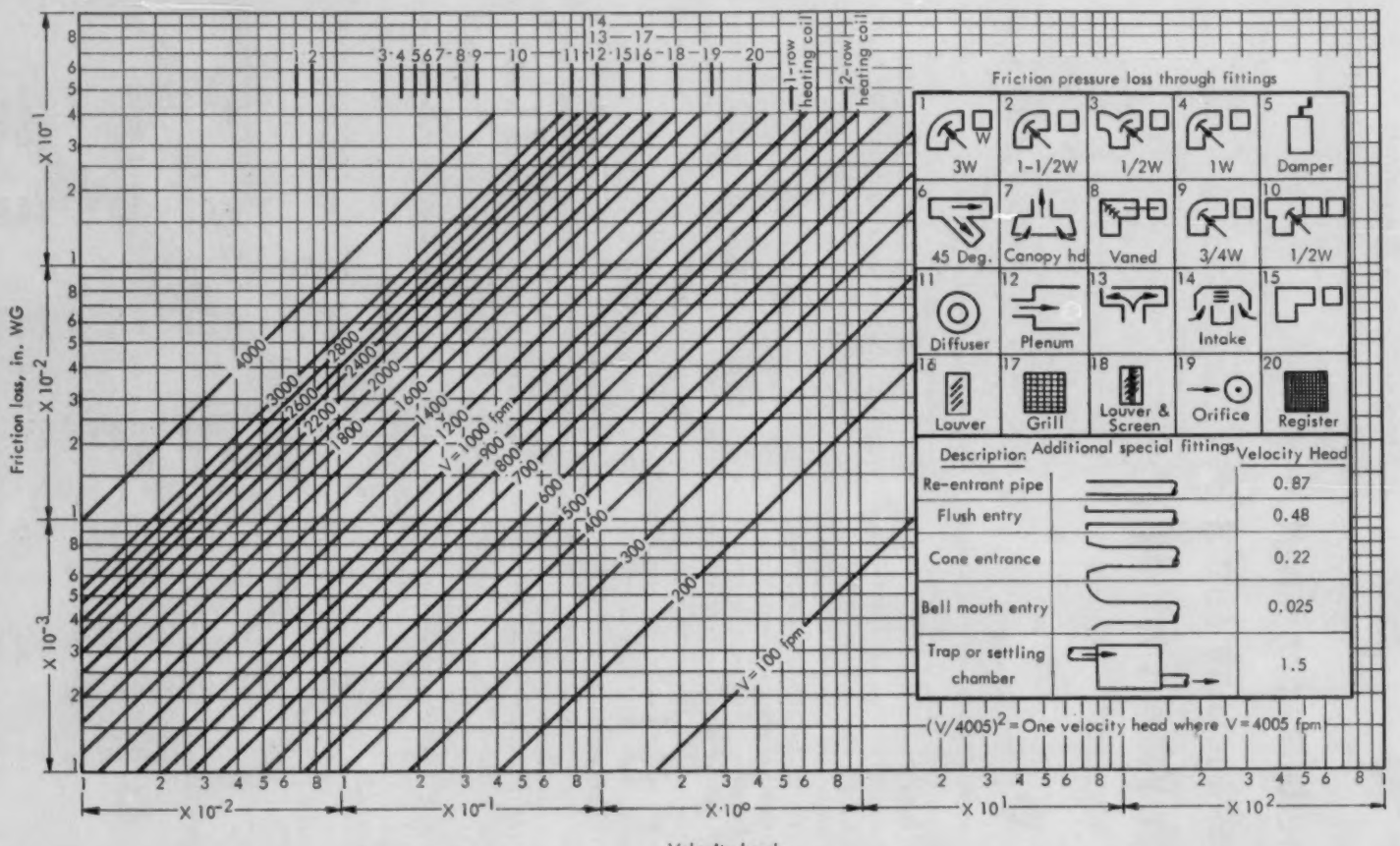
Maintain Constant Air Weight

In the determination of friction loss in ducts and fittings, correct for high temperature and/or greater elevations by increasing air volumes, by use of the reciprocal of density to keep the same weight of air flowing into the system as handled by the fan.

Determine duct sizes and pressure losses as if the corrected volumes were at standard conditions. Table 1 gives density factors for both elevated temperature and altitudes. Interpolation in Table 1 may be made as desired. ≠

TABLE 1 — DENSITY FACTORS for above-standard temperatures and elevations, should be applied to standard-condition air volumes to keep weight of air entering system constant

Air temperature, F	Altitude above sea level, ft								
	0	1000	2000	3000	4000	5000	6000	7000	8000
	Barometric pressure, in. Hg								
	29.92	28.86	27.82	26.81	25.84	24.89	23.98	23.09	22.22
70	1.040	1.003	0.967	0.932	0.898	0.865	0.833	0.803	0.772
100	.984	.948	.915	.882	.850	.818	.788	.759	.731
150	.904	.872	.840	.801	.781	.752	.724	.698	.672
200	.835	.805	.777	.749	.722	.694	.668	.645	.620
250	.777	.749	.722	.696	.671	.647	.622	.599	.577
300	.725	.699	.674	.649	.628	.603	.580	.560	.538
350	.680	.656	.632	.609	.588	.566	.545	.525	.505
400	.641	.618	.596	.574	.553	.533	.512	.495	.476
450	.605	.583	.564	.543	.523	.503	.485	.467	.450
500	.574	.553	.534	.515	.496	.477	.460	.443	.426
550	.546	.526	.508	.490	.472	.454	.438	.421	.406
600	.520	.501	.484	.466	.449	.433	.416	.401	.387
650	.496	.478	.462	.444	.428	.413	.397	.383	.368
700	.475	.458	.442	.426	.411	.395	.381	.367	.354

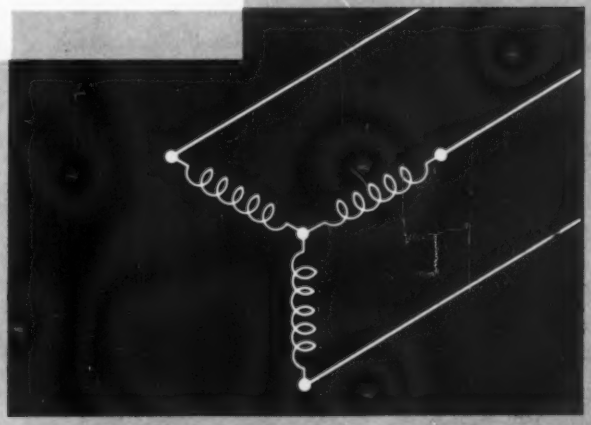


PRESSURE LOSSES through any fitting shown on this chart can be determined when only air velocity (slant lines) is known. Fittings are keyed by number, at right, to corresponding velocity head value at top of chart. Intersection of velocity head line with air velocity line yields friction loss directly. Chart is based on standard conditions of 70 F, 29.92 in. Hg

HPAC ENGINEERING DATA FILE

When, How, and Why To Consider The Use of ELECTRIC HEATING

- *Energy costs not only concern*
- *How to estimate energy requirements*
- *When electric heat is attractive*
- *What types of units are available*
- *Applicable codes and standards*



Direct electric space heating is considered for many space heating applications. While electrical energy costs in most localities are higher than those for other energy sources, total owning and operating costs of the electric heating system are sometimes competitive and may be less than those for other systems. In addition, the convenience of using direct electric heating in certain applications, for example for terminal reheat in spaces with variable occupancy, may outweigh operating cost considerations.

The changing relationship of basic energy costs, increasing internal loads, and a wide variety of electric heating equipment have made direct electric heating another available method. Wisely used, electric heating can serve economically and satisfactorily in many applications. Only careful engineering study — with all the necessary facts at hand — can determine when electric heating should be used. It should be given consideration when conditions indicate its feasibility.

ELECTRICAL ENERGY, once considered too costly as an energy source for space heating, has become competitive with other energy sources in many localities. To be sure, unit energy costs still remain above those for fossil fuels in almost every area and every kind of service, but total owning and operating costs are sometimes competitive.

Many factors have contributed to the changing relationship of basic energy costs which requires consideration of electrical energy as a prime energy source for heating and makes it another heating tool. Among them are the now well known differentials between summer and winter peak loads on many utilities, availability of a wider variety of electric heating equipment, and the increasing internal electrical loads brought about by new lighting standards, office automation, and increasing use of interior space which has no weather-exposed surface. In some cases, a structure may be heated electrically whether those concerned like it or not because of the high internal heat gains encountered.

That electrical energy is becoming economically feasible for commercial, industrial, and institutional space heating is evidenced by the increasing number of "all electric" building projects being announced. Electric heating — particularly resistance heating — is still in its infancy, but applications in these classes of buildings are growing in number and current trends indicate continued growth as competition between the energy sources continues to sharpen. It is both necessary and desirable, therefore, that the engineer and contractor be aware of the ways in which electric heating can be applied and what must be considered when applying it.

In this report, only direct electric heating will be considered. Direct electric heating units include the various resistance heating devices including the electric infrared heater. The heat pump, which can and should be considered a form of electric heating and cooling when electrically driven, will not be considered here. The heat pump has many advantages over direct electric heating, including its seasonal COP of 2 to 3 which gives lower operating costs, and the capacity to transfer heat from overheated interior areas to perimeter areas which require heat — thereby conserving energy. Capital investment and maintenance costs are higher with the heat pump and these tend to offset in part the advantages gained from the higher COP. Recent articles in Heating, Piping & Air Conditioning haxe explored the design considerations for heat pump installations using the heat pump to reclaim heat waste and in conventional heating and cooling applications, so only direct heating is considered herein.

Economics — A Primary Consideration

Because electrical energy must compete with other energy sources for heating loads, much of the current discussion of electric heating necessarily centers about operating costs so the economic analysis of a proposed system assumes paramount importance during the early stages of design. While electric heating is frequently given little consideration because of high unit energy charges in equivalent Btu, experience indicates that more than energy charges must be considered in a realistic economic analysis for a proposed project.

Many analyses have been presented in the literature to demonstrate on the one hand that electric heating is economically feasible and on the other that it is not and can not be competitive. No attempt is made here to establish an economic model for comparative purpose as each project must be considered on its own merits. Regional influences, the character of the structure, what is expected of the system, the type of occupancy, and many other factors enter into the final decision to utilize electric space heating which can best be evaluated by the engineer for a specific project and full consideration of these can ultimately tip the scale from one source of energy to another. No simple solution exists to making the economic analysis. Here are some factors that must be taken into account when making such an evaluation.

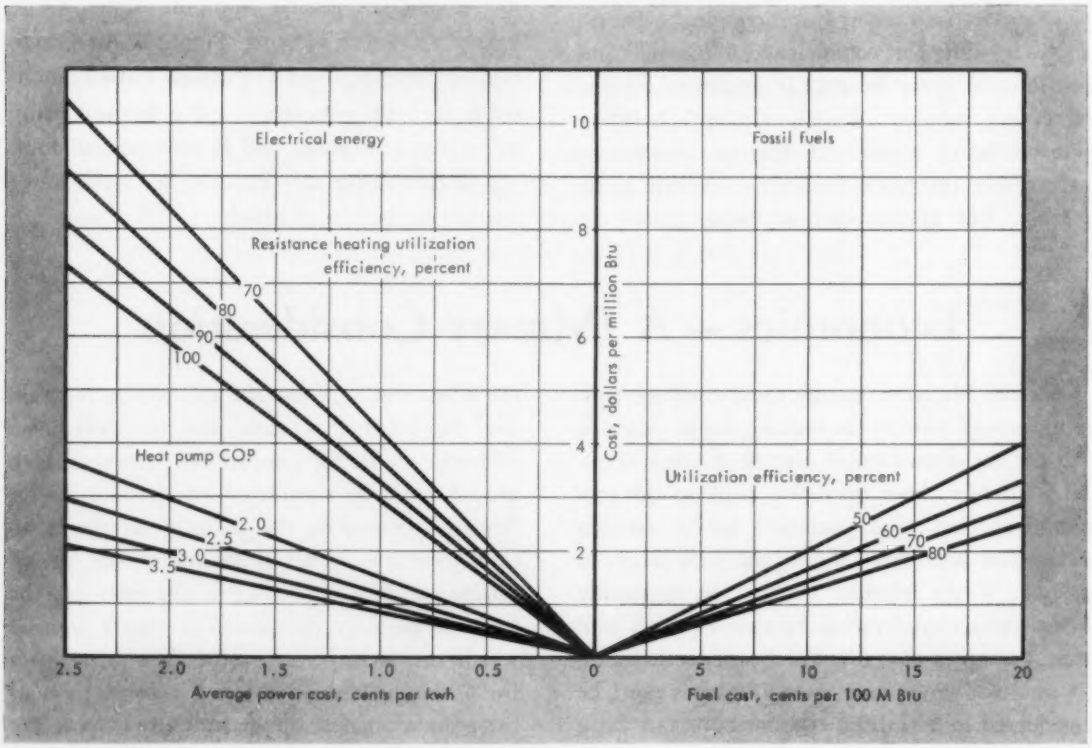
Energy Charges

One of the first considerations in comparing the various energy sources is the cost of energy as this represents the major portion of the owning and operating cost, not including fixed charges. Fig. 1 gives a comparison of energy costs per million Btu for various unit energy costs. It should be noted that utilization efficiencies have been indicated for the fossil fuels and electric resistance heating, and the coefficient of performance for the heat pump.

Utilization efficiency is defined here as the ratio of the quantity of heat actually used in the heated space or structure to the energy input at the device which converts the energy to heat. Losses which decrease the utilization efficiency include standby losses, losses in transmission from the heat source to the heated space, and losses in energy conversion.

In the case of electric resistance heating with resistance units located within the heated space, standby losses and losses in conversion are negligible. Transmission losses are relatively small and are incurred because of resistance of the conductors and the losses in transformers when these are required. When either of these are so located that the heat losses occur within the heated space, they need not be considered. When outside the heated space they should be included in the economic analysis, particularly when the total heating load is large.

Transmission losses in feeders at maximum loading are limited by design to 1 to 2 percent by local and national electrical codes. It should be noted that transmission losses occur only when heating is required. Feeder losses may be decreased by increasing the feeder size at the penalty of increased initial cost and an economic balance must be struck when loads are large. Transformers by nature are efficient devices and losses amount to 1 to 2 percent depending upon primary and secondary voltages and loading. In



1 ENERGY COSTS are primary consideration in selection of any fuel for a particular heating service. Chart permits determination of energy cost per million Btu usefully utilized to heat occupied space when average power cost (including both demand and energy charges) or fuel cost per 100 MBtu (therm) is known. Utilization efficiency must account for losses in energy conversion, transmission heat losses, and standby losses during idling periods. Energy costs alone don't tell the whole story though and other costs of operation and ownership must be taken into account

general, the utilization efficiency for electric resistance heaters located in the heated space can be considered 100 percent.

When electric resistance heaters are utilized to heat a circulating medium such as water or air, transmission and standby losses should be considered. These become important only when the ducts or piping are located outside the heated space where the vagrant heat losses do not contribute to useful heating of the structure.

In the case of the heat pump, the duct and piping transmission losses should be considered in addition to the COP. These losses are comparable to those for any water or air distribution system and are significant only when the losses occur outside the conditioned space.

Further Study Needed

The dearth of information available at present on overall operating or utilization efficiencies of heating systems in contemporary commercial and institutional buildings regardless of energy source suggests the need for further study since much of the information in use today is based upon architectural and mechanical design practice in the 1930's and 1940's.

In a recent paper, R. E. Bohonan presented[1] steam usage data for 10 postwar buildings heated with district steam as the prime energy source. The buildings were of contemporary construction and included wide ranges of glass-to-wall area ratios, tight window construction (double glazing in some cases), internal loads representative of structures of the early 1950's (2 to 5 watts of lighting per sq ft), and well zoned heating systems. On the average, these buildings required about 20 percent less heat from the heating system than their prewar counterparts. Within the group studied, however, steam consumption per 1000 cu ft per deg day varied by a ratio of 2 to 1 with the lowest seasonal heating requirement being approximately one-half of the average for older buildings.

How to Estimate Seasonal Heat Loss

Sufficient evidence exists in the literature to indicate that the long accepted degree day method of estimating energy requirements is of questionable value for predicting operating costs of electric heating installations. Metered records indicate considerable error with the metered energy consumption being significantly less than values predicted by the degree day method — particularly when resistance heating units are located within the occupied space.

Considering the changes which have taken place in design and construction as noted previously, improved control through zoning, and increased internal loads, this should not be surprising and, in fact, the use of the degree day method for estimating operating costs regardless of the energy used should be questioned.

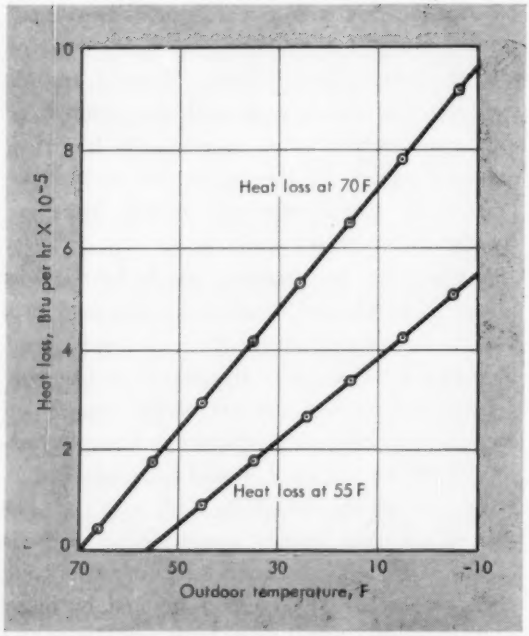
Because of the relatively high unit cost per Btu of electrical energy, more precise methods of estimating seasonal energy requirements have been employed. The method favored by many electric utilities based upon their experience and the reliability of the results obtained employs numerical integration of the heat loss at various ranges of outdoor temperature. Tabulations have been made locally from Weather Bureau data giving the number of hours at various outdoor temperatures during the heating season. The hours at each temperature are multiplied by the appropriate estimated heat loss and the products summed up to obtain seasonal energy requirements. The procedure is best illustrated by an example for a building with the following assumed characteristics and design conditions:

Outdoor design temperature: −10 F
Indoor design temperature occupied: 70 F
Indoor design temperature unoccupied: 55 F
Floor area: 20,000 sq ft
Transmission heat loss: 34.13 Btu per hr per sq ft (10 watts per sq ft) or 682,600 Btu per hr (200 kw)
Ventilation rate when occupied: 0.2 cfm per sq ft (4000 cfm)
Ventilation heat loss: 345,000 Btu per hr (101 kw)
Installed lighting load: 5 watts per sq ft (100 kw total installed load)
Occupancy averages 150 people 8 hr per day.

1) From the above, determine the heat loss for various conditions at which the plant will be operated as follows:

Heat loss when occupied at −10 F and 70 F: 1,027,600 Btu per hr
Heat loss when unoccupied at −10 F and 70 F: 682,600 Btu per hr

[1]Bohonan, R.E, *Heating of Post-War Buildings*, Proc. National District Heating Association, Vol. L, 1959.



2 HEAT LOSS CURVES plotted for various operating conditions assist in estimating seasonal energy requirements when local temperature frequency data are used in estimating procedure. These values were used in example for which summary of seasonal energy requirements is listed in Table 1

Heat loss when unoccupied at −10 F and 55 F: 555,000 Btu per hr

2) Establish percent of time during week that system will operate at the above design heat losses:

	Hours	Percent
Occupied (assume 9 hr per day)	45	26.8
Unoccupied at 70 F (2 hr pickup time)	10	6.0
Unoccupied at 55 F	113	67.2
	168	100.0

3) Determine average heat loss with control at 70 F. This must be weighted according to the time required for pickup during which time ventilation is not used and during the occupied hours when ventilation is required:

Average heat loss = (45/55) × 1,027,000 + (10/55) × 682,600 = 960,000 Btu per hr

4) Plot the heat loss at each control temperature as a function of the outdoor temperature as shown in Fig. 2. From this set of curves, the heat loss at any average outdoor temperature can be obtained.

5) Complete table similar to Table 1 in which local outdoor temperature data and hours each season at each average outdoor temperature have been tabulated.

The seasonal heat loss of 1213.7 MMBtu or 355,500 kwh in Table 1 represents the gross heating requirement for the assumed structure. Credit must be taken for lights, heat gains from occupants, and other internal and external heat gains when it is certain they will exist to obtain net heating requirements. Some credit must be taken for internal heat gains when using this method of estimating seasonal heating requirements since no credit has been taken for them up to this point. The degree day method of estimating heating requirements has a credit for heat gains built into it but these gains reflect internal loads, solar heat gains, and occupant densities at lower levels than would commonly occur in contemporary structures.

A second method frequently used for estimating gross energy requirements is the "Calculated Heat Loss Method" as presented in the ASHRAE *Guide*. When this is applied as outlined in the *Guide* to the above example, the gross heating requirements are estimated to be 1284 MMBtu or about 6 percent higher than that by the preceding method. It should be noted that the *Guide* average temperature data applies only for the period October 1 to May 1. In the preceding method, the data apply for October through May. If the *Guide* method is applied for October through May (243 days instead of 212 days), the estimated gross heating requirements are 1474 MMBtu or about 22 percent above those calculated with the preceding method. The error in the latter can be attributed to the fact that the average temperatures given in the *Guide* can not be extended to cover the month of May. If May temperatures were included in the average temperatures in the *Guide*, the average would be higher and the estimated energy requirements correspondingly lower.

In view of the differences that exist between the various methods for estimating gross heating requirements, a uniform method should be used when comparing seasonal costs for the various energy sources. Comparisons made with different methods of calculation can obviously lead to widely different net seasonal heating

requirements. However, the total useful energy (not heat input) must be the same for any system if comparable degree of control is used.

Must Consider Internal Gains

As noted above some credit must be taken for internal heat gains from people, lights, etc. The significance of these loads becomes apparent if it is assumed that 80 percent of the installed lighting in the above example will contribute useful heat to the space, and that the average occupancy will be 150 people for 8 hr each working day. The total heat gain from these two sources is estimated to be:

Lighting: 0.8 × 100 × 152 × 9	=	109,500 kwh
People: (300/3413) × 152 × 150 × 9	=	18,000 kwh
		127,500 kwh

In the example, these two internal loads contribute approximately 36 percent of the estimated gross heating requirements. Other internal loads which can be depended upon to provide useful heat also should be included in the estimate.

Solar heat gains can contribute materially to a reduction in seasonal energy requirements in contemporary structures. The more carefully a system is zoned the greater the effect of solar heat gain in reducing operating costs. At present there is no simple method by which solar heat gains can be accounted for and the labor required to include them suggests that they be omitted.

Some care must be exercised when making the estimate of seasonal heating requirements that the precision of the calculations does not exceed the accuracy of the various factors involved. The final result can only be a qualified estimate regardless of how detailed the calculations may be.

Consider Demand Charges Too

The average cost per kwh plotted in Fig. 1 should be understood to include any demand charges attributable to the operation of the heating system. In some localities, demand charges add considerably to the average cost per kwh used for heating and will continue to remain a significant part of the energy costs. This is particularly true in northern climates where winter peaks continue to advance at approximately the same rate as summer peaks. Some northern utilities foresee no change in demand charges in the immediate future for this reason.

In the south, where air conditioning has caused striking and rapid increases in summer peak loads, the demand charges for heating loads often are more liberal and in some areas are non-existent. One southern utility, for example, bases a fixed demand in the "all electric" building on an actual count of the connected electrical load. When at least 40 percent of the connected load is in active water heating, cooking, process heating, or space heating, the consumer qualifies for fixed demand billing. The fixed demand is based upon a percentage of only the lighting, refrigeration (not including refrigera-

TABLE 1 — SUMMARY of seasonal heating requirement calculation using local outdoor temperature—time data

Outdoor temperature range, F	Average outdoor temperature, F	Hours			Heating requirements			
					At 70 F		At 55 F	
		Per year[1]	At 70 F	At 55 F	Heat loss, Btu per hr	Heat loss, MMBtu	Heat loss, Btu per hr	Heat loss, MMBtu
−10 - − 1	− 5	41	13.5	27.5	900,000	12.1	510,000	14.0
0 - 9	5	162	53	109	780,000	41.3	430,000	46.8
10 - 19	15	316	104	212	660,000	68.6	350,000	74.2
20 - 29	25	847	278	569	520,000	144.4	275,000	156.3
30 - 39	35	1613	530	1083	420,000	222.1	180,000	195.0
40 - 49	45	1108	363	745	300,000	109.0	90,000	67.0
50 - 59	55	889	291	—	180,000	52.4	—	—
60 - 69	65	532	174.5	—	60,000	10.5	—	—
				Totals		660.4		553.3
				Gross heating requirements				1213.7 MMBtu

[1]*Average hours given here are for a locale with 6300 deg days per year. Average annual hours based on 9 year record are sum of hours for months of October through May. Comparable data for other areas can be obtained from local weather bureau data.*

tion for air conditioning), and miscellaneous power loads. The economies of this method of billing become most evident when comparing year around costs because without the heating load, measured demand is used which results in higher energy charges for air conditioning and other loads. Incremental costs for added loads such as heating may be as low as 5 to 8 mils in this rate structure.

Whether demand charges will be significant can only be determined from study of the local rate structure and the total electrical loads involved. In some instances, the heating demand may be limited by proper control so that it doesn't add to the demands of other loads or at least will cause a minimum increase in the total measured demand. This can be done by staged control, sequence operation, and by doing any necessary preheating following night setback when other loads are not yet active. In some cases, the addition of a resistance heating load may provide sufficient power factor correction to offset a substantial part of the increased demand due to heating.

Maintenance Requirements Low

Aside from air handling components when resistance heating coils are used in conjunction with air distribution systems, relatively few components of the direct electric heating system require maintenance. Switch gear, transformers where used, and controls require periodic inspection but overall their maintenance requirements are relatively small as compared to those for mechanical systems. The resistance elements are essentially "go — no go" devices and with the exception of replacement in the event of failure no maintenance can be performed upon them. Occasional cleaning in atmospheres containing relatively large quantities of lint may be required if the configuration of the element is such that lint will accumulate on it.

The life of the resistance heating element is related to the temperature at which it operates with life decreasing as the temperature increases. Proper selection of the coils in air systems and utilization of other types direct heating devices with low watt densities will assure long life.

The differential in maintenance costs must be accounted for in the economic analysis and these normally would favor electric heating. Low maintenance requirements are also an intangible advantage in installations where it can be assumed that very little or no preventive maintenance will be performed.

Fixed Charges Must Be Included

A realistic appraisal and comparison of electric heating with other energy sources requires close coordination of mechanical and architectural designers during architectural design. Coordination during design — always beneficial to the owner — is of more importance when electric heating is contemplated because of the effect of architectural design on heating requirements.

One aspect of electric heating which sometimes makes it the proper choice for a structure is low initial cost — due primarily to lower space requirements for equipment and services. Failure to account for this in design and in the economic analysis will place electric heating at an unfair disadvantage. Particularly in smaller structures such as schools, churches, etc., electric heating is justified economically on the basis of low initial cost with correspondingly lower annual principal and interest payments which become an important part of owning and operating costs. First costs must be lower in most cases to offset the differences in operating cost if owning and operating costs alone are the reason for selecting electric heating.

Total project costs must be considered when determining the owning and operating costs for economic comparisons. Lower initial costs due to elimination of space devoted to combustion equipment and the cost of the stack and fuel storage facilities where required, are offset in part by the cost of space devoted to transformer vaults and load centers, and the cost of increased insulation required to bring electric heating costs within reason. Therefore, savings, if any accrue, are indicated only by total project costs.

An indication of the savings that must be made in initial costs to justify electric heating can be determined from the example structure

for which seasonal energy consumption was estimated. The net heating requirements (gross — credit for lights and people) for the stated conditions are 778.7 MMBtu or 227,000 kwh. If electric power costs including demand and energy charges are assumed to be a favorable 1.5c per kwh and fossil fuel costs 10c per therm with a utilization efficiency of 70 percent, the respective seasonal costs are $3405 and $1112, respectively. This leaves an annual difference of $2293 to be made up by lower fixed charges and maintenance costs of the electric heating system, and the cost of operating the auxiliary equipment of other systems. Assuming 20 year repayment, and an average interest rate of 5 percent with a differential in the costs of maintenance, operation ot auxiliaries, etc, of $293 per year, the necessary difference in initial cost to compensate for the difference in operating costs amounts to $1.34 per sq ft for the 20,000 sq ft building.

It is interesting to note that if the transmission heat loss is assumed to be twice that used in the previous example with other factors remaining constant, the differential in operating cost amounts to $4750 per season. Assuming $600 per year lower maintenance and operation costs (auxiliaries) for the electric heating system in this case, the difference in initial cost required to compensate for the difference in operating costs amounts to about $2.77 per sq ft. These values are given only to show that this analysis is sensitive to many factors and that no generalization can be made concerning the applicability of electric heating. Each project must be considered individually. However, it is evident from these two sets of conditions that as the dollar differential in energy charges decreases because of increased internal loads or reduction in heat loss, electric heating becomes more competitive with fossil fuels.

When Electric Heating Should Be Considered

Aside from localities in which electrical energy charges are competitive with other energy sources, electric heating should be considered in the following situations:

1) When the seasonal heating requirement of the structure is low because of low heat losses or high internal heat gains. This results in a smaller dollar cost differential for energy which may be offset by the lower first costs and maintenance costs of the electrically heated structure.

2) Where the period of usage at comfort level is short or intermittent such as in schools, churches, and motels. Simplicity and flexibility of control, and conversion of energy to heat at the point of use permits heating only those spaces occupied at any particular time and eliminates standby and transmission losses associated with central systems. Additionally, short periods of usage result in low seasonal energy requirements.

3) In additions to existing structures when the existing boiler plant or the distribution system cannot be expanded economically and space for construction of additional plant is limited. Direct electric heating permits expansion of a system with a minimum of expense and space requirements.

4) For terminal reheat at remote locations where an existing piping system cannot be extended economically. Terminal reheat is often desirable in spaces having widely varying occupancy, such as conference rooms.

5) When other electrical loads create demands during occupancy which exceed those of the heating system and consume large quantities of energy so that the incremental cost of heating kwh is at a favorable level.

6) Where it is expected that maintenance capability of the owner is limited and low maintenance requirements will be advantageous.

Some Points to Observe In Design

Because of the relatively high cost of electrical energy, it is essential that every effort be made in design to minimize the heat loss of the structure and to control the energy input at just

the right amount needed for any set of conditions to effectively utilize electric energy for space heating. Some points to observe include:

1) Provide adequate thermal protection: Insulation is desirable with any energy source but it is a necessity with electric heating. The term insulation is broadly used here to include thermal protection for any type of exposed surface, including glass. The most obvious and best way to reduce heat loss through glass areas is to keep them at a practical minimum. The next best is to provide double glazing. Since one square foot of glass permits as much heat loss as five to six square feet of normally insulated wall, the advantages of keeping glass area to a minimum are obvious.

In addition to reducing operating costs, insulation provides other benefits including:

- Lower initial equipment costs due to reduction of installed capacity.
- Lower space requirements for equipment.
- Lower heat gains and correspondingly lower initial costs and operating costs if the structure is air conditioned.
- Higher levels of comfort because of higher interior surface temperatures during the heating season and lower surface temperatures during the summer.

While the benefits of insulation have been understood for many years, they have not always been utilized to advantage. The economic necessity of providing a high degree of thermal protection for the electrically heated structure has emphasized these benefits. Furthermore, for the same reduction in heat loss, the annual dollar savings with electric heating will be from 2 to 3 times that using fossil fuels. Thus, a greater insulation thickness can be justified when electric heat is used.

2) Provide controls for careful scheduling of electric heating. Improper control and control failure have caused excessive heating costs in electric heating systems. Minimum operating cost or maximum economy results when maximum use is made of the flexibility of the electric heating system. Controls should be provided to take advantage of this feature through multiple zoning, by staging units to modulate heat input rate, by careful scheduling of reduced temperatures at nights and weekends, elimination of ventilation air during unoccupied periods, and limiting demand, especially during pickup periods.

3) Select units carefully to meet design loads without safety factors. Oversizing of units increases demand during pickup periods which will increase costs where demand charges must be considered.

4) Consider minimizing ventilation air by the use of activated charcoal for air recovery. Since ventilation air load is an important part of the total heating load, air recovery can effect significant savings. As in the case of insulation, the relatively high unit cost of energy increases the dollar savings over those experienced with fossil fuels.

What Types of Units Are Available

A variety of direct electric heating units are available to the designer. Most electric units with few exceptions, are similar in both appearance and function to terminal heating devices found in hydronic, steam, and air heating systems. Thus, application from a comfort standpoint does not differ appreciably from good design practice. Some of the units available are listed in Table 2. Capacities vary from a few hundred watts in units suitable for heating small spaces to 100 kw and more in units designed for use in central systems or for heating large spaces. No attempt is made here to delineate specific characteristics of each type of unit. These vary from manufacturer to manufacturer. However, some general observations about the direct electric heating units are of interest.

Types of Resistance Elements

Basically two types of resistance elements are employed in space heating equipment. These are bare resistance wires and sheathed resistance elements. The latter are comprised of resistance

wire embedded in refractory material under pressure to assure good contact between wire and ceramic, and this assembly is enclosed in a sealed metal sheath. Various sheath metals are available for ordinary conditions and for services requiring corrosion resistance or high element temperature. Iron is a common sheath material in air heating devices but high alloy sheaths are available for exceptional conditions. The sheath material employed establishes the maximum temperature at which the element can be operated for acceptable service life. Whether sheathed or bare resistance wire is employed, operating life is related to the temperatures at which the exposed surface is operated. Within limits, the lower the temperature the longer will be the life of the element.

Sheathed elements are generally fitted with extended surface to improve heat transfer. In baseboard units, simple fin configurations are used — usually a single fin — to avoid trapping the lint and dust, which can easily be induced into the unit because of the low location of the intake. In forced convection equipment, conventional finned surfaces are employed when the sheathed heater is used for this service.

In general, units are designed to operate with the element at temperatures below incandescent temperatures. However, element temperatures may be in the range of 600 to 800 F when the elements are used at maximum capacity.

Output Fixed—Temperature Varies

One characteristic of the resistance element should be reviewed. The heat output of a resistor is constant as long as the applied voltage is constant. Thus, the temperature of a resistance element designed for air heating will increase as the air flow is decreased. If the air flow is not maintained above some minimum value depending upon the design of the coil, a high resistor temperature will result which will shorten service life, or in extreme cases cause immediate burnout of the element if the unit is not properly protected with high limit controls. This is in contrast with water and steam coils in which the maximum temperature is limited by design and output varies with changing air flow.

TABLE 2 — DIRECT ELECTRIC heating units are available in many forms similar in appearance and function to terminal units employed in systems using other energy sources. These include the following:

Baseboard heaters
Cabinet convectors — gravity and forced
Radiant glass panels
Unit ventilators
Unit heaters
Fan-coil unit ventilators
Resistance cable for panel heating (floor and ceiling) and snow melting
Immersion heaters for hot water, steam, and other heat transfer fluids
Air heating coils
Hot water generators
Infrared heaters
Electric furnaces

Selection of air heating coils must take into account minimum recommended velocities for the coil used. The latter are established by the manufacturer and safety tests conducted by Underwriters' Laboratories are carried out at these minimum velocities. Coil placement in the air duct system should be made so that uniform air distribution is obtained across the face of the heater to avoid local overheating of elements. Installation within 10 diameters of turns and other obstructions should be avoided unless turning vanes or flow straightening sections are employed.

Safety Controls

Because of the constant energy output characteristic, it is imperative that the electric resistance coils be protected with safety controls which will operate to shutdown the heater in the event of air flow failure. U. L. listed air duct coils are furnished with high limit controls which automatically limit discharge air temperature to 200 F. Additional protection should be provided by arranging to open the air heater circuit in the event of fan failure or unauthorized fan shutdown.

High limit cut-outs are provided for this purpose in unit heaters, convectors, etc. Linear elements are frequently employed in baseboard heaters to protect against stoppage of air flow or radiant heat loss at any point on the baseboard

such as might occur if it were covered with cloth or paper. Though not standard on all baseboards, this appears to be a desirable feature whenever the possibility exists that pillows, paper, or other such material may fall to cover the baseboard and stop air flow through it.

What Rating Voltages

The electric space heating units designed for commercial and industrial applications are available in voltages commonly used in such applications. Within limits, commercial units of all types can be obtained in almost any single or three phase voltage desired. Smaller units, however, which serve for both residential and commercial applications, are generally rated for 120/240 volts.

It should be noted, however, that other than standard voltages are sometimes used for rating the smaller units. The rated voltage is important in determining unit capacity as is the terminal voltage when installed in determining operating capacity. Since the heat output is proportional to the square of the voltage, a relatively small voltage difference results in a large drop in capacity. For example, a two percent voltage drop will result in a four percent decrease in capacity. Because an increase in capacity can be obtained only by replacing the unit or by stepping up the voltage, careful selection of the units initially is in order, particularly when the design heat loss requirements have been calculated as close as possible.

Modulation By Staged Control

Perhaps the one significant advantage of the direct electric heating unit is the simplicity with which multiple zoning can be accomplished and the flexibility in control which this implies. Counter balancing this is the difficulty encountered in modulating the rate of heat input to achieve maximum comfort — particularly with the simpler forms of electric resistance heating units.

Modulation of input can only be accomplished by varying the total resistance of the unit when the voltage is fixed, by varying the voltage when the resistance is fixed, or by a combination of the two. The constant heat output characteristic precludes the use of face and bypass control, which would only cause the resistor to overheat.

Some smaller units are equipped with resistance elements constructed in two parts each having one-half the rated capacity. This permits simple modulation at fixed voltage by means of a two stage thermostat. Another approach is to vary the voltage by dropping to the line-to-ground voltage on the low stage. Since the lower voltage is typically one-half of line-to-line voltage, the heat output on the low stage is only one-fourth of the rated capacity.

In larger units and in air heating coils, staging is accomplished by operating groups of the individual elements in parallel at fixed voltage. The number of steps in capacity that can be obtained depends upon the number of elements in the coil and the type of circuit used.

What Standards Apply

Three codes or standards are of interest in the application of direct electric heating devices. Construction, material, and equipment should conform to the National Electrical Code and governing local codes.

Safety standards for space heating equipment are set forth in Underwriters' Laboratories, Inc. standard UL 573 "Electric Space Heating Equipment." The UL standard sets requirements providing safe surface temperatures adjacent to combustibles, establish clearances between unit and combustibles when necessary, and includes other requirements related to abnormal conditions such as loss of air flow, etc.

The National Electrical Manufacturers Association has published a standard concerned with performance of direct electric heating equipment. The standard, Publication HE 2-1959, is primarily concerned with units applied for residential space heating but some units covered are equally applicable to small commercial installations. These standards go beyond safety requirements and set limiting outlet temperatures, standardize ratings and rating voltages, and establish other performance tests and criteria related to service life, cleanliness, lengths, etc.

Flexpipe® CONNECTORS

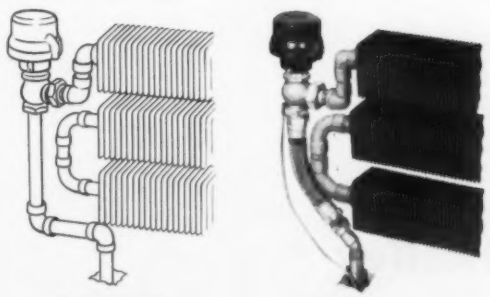
SHORTEST DISTANCE

to simplified installation, to lower maintenance cost

For any trouble spots where hot water, steam, oil, gas must be carried . . . for line vibration, piping travel, misalignment problems . . . Flexpipe tin-bronze flexible connectors fill the bill! They're easy to install in tight quarters, and handle expansion and contraction caused by wide variations in temperature. Flexpipe ends costly, laborious installation of elbows, couplings, short runs of pipe.

WHERE TO BUY: Leading wholesaler distributors can furnish complete information about Flexpipe in standard sizes. For name and address of distributor serving your area, or for more detailed information, write to: Anaconda Metal Hose, Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-051

How Flexpipe ends costly, laborious installation of elbows, couplings, short runs of pipe.



RIGID PIPING FLEXPIPE

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product

FIRST PRE-PACKAGED

electric storage water heater for commercial, industrial and institutional use.

The new P-KW is the first electric storage water heater to be offered as a standard package unit. It is shipped fully wired, insulated and factory tested. It requires only electrical and water connections to place in operation.

The new unit is equipped with immersion heater, control thermostat, magnetic contactors, circuit breaker, panel control box, ASME temperature and pressure relief valves, thermometer, pressure gauge, metal jacketed insulation, and integral support skids.

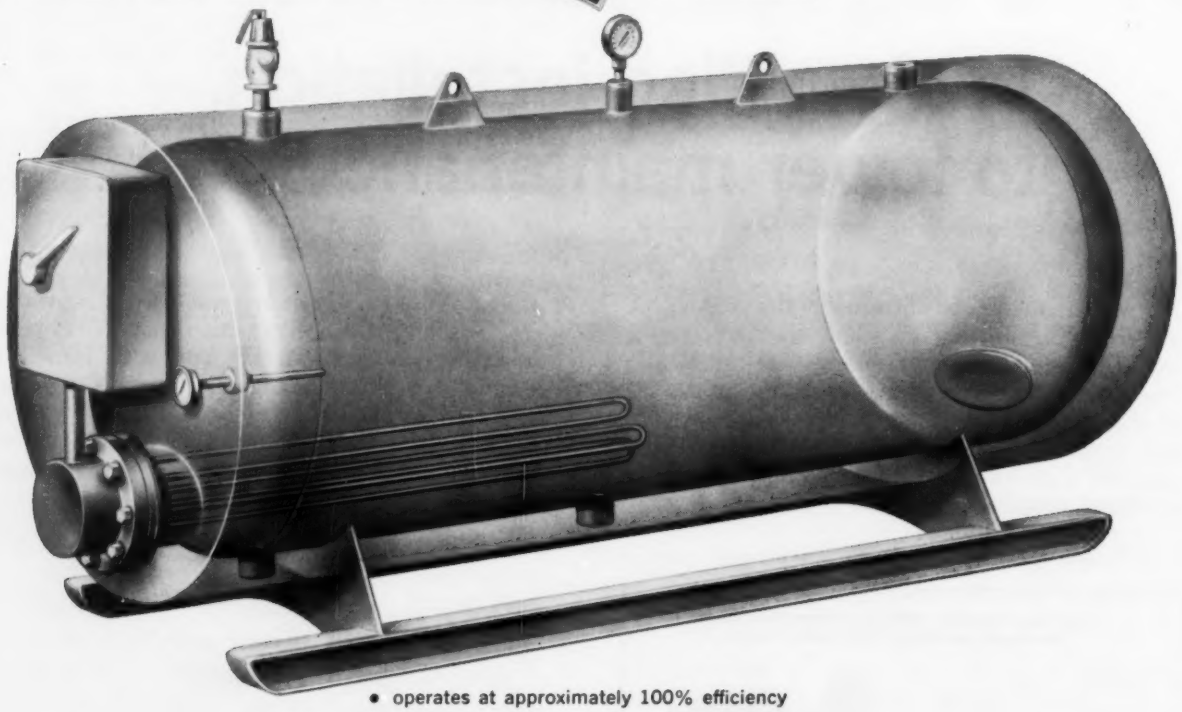
Made by P-K on a custom basis for many years, P-KW Electric Storage Water Heaters are designed and fabricated in accordance with the ASME Code and Federal, State and local regulations.

Components that comprise the electrical system, including wiring, meet the requirements of Nema standards and the National Electrical Code.

The immersion heating elements are operated approximately 10 per cent below their voltage capacity—assuring long, trouble-free service. The thermal conversion approximates 100 per cent efficiency.

Pre-packaged P-KW water heaters can be selected for three working pressures – 100, 125, and 150 psi.

WRITE FOR CATALOG NO. P-KW-1: contains diagrams, specifications, complete engineering and performance data. Address your request to: The Patterson-Kelley Co., Inc., 39 Morgan Avenue, East Stroudsburg, Pa.



- operates at approximately 100% efficiency
- storage capacities from 284 to 1,300 gallons
- recovery capacities from 41 to 410 gph
- horizontal or vertical design
- safe, silent, automatic

Patterson Kelley

OCTAGON

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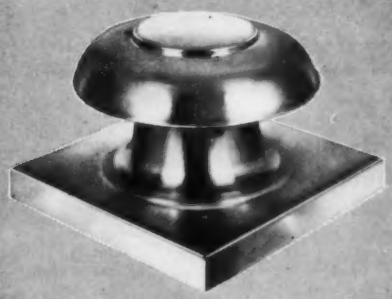
VENT-X-IT

VOLUME VENTILATION WITH STREAMLINED STYLING

TYPE C DIRECT DRIVE
CENTRIFUGAL VENTILATORS

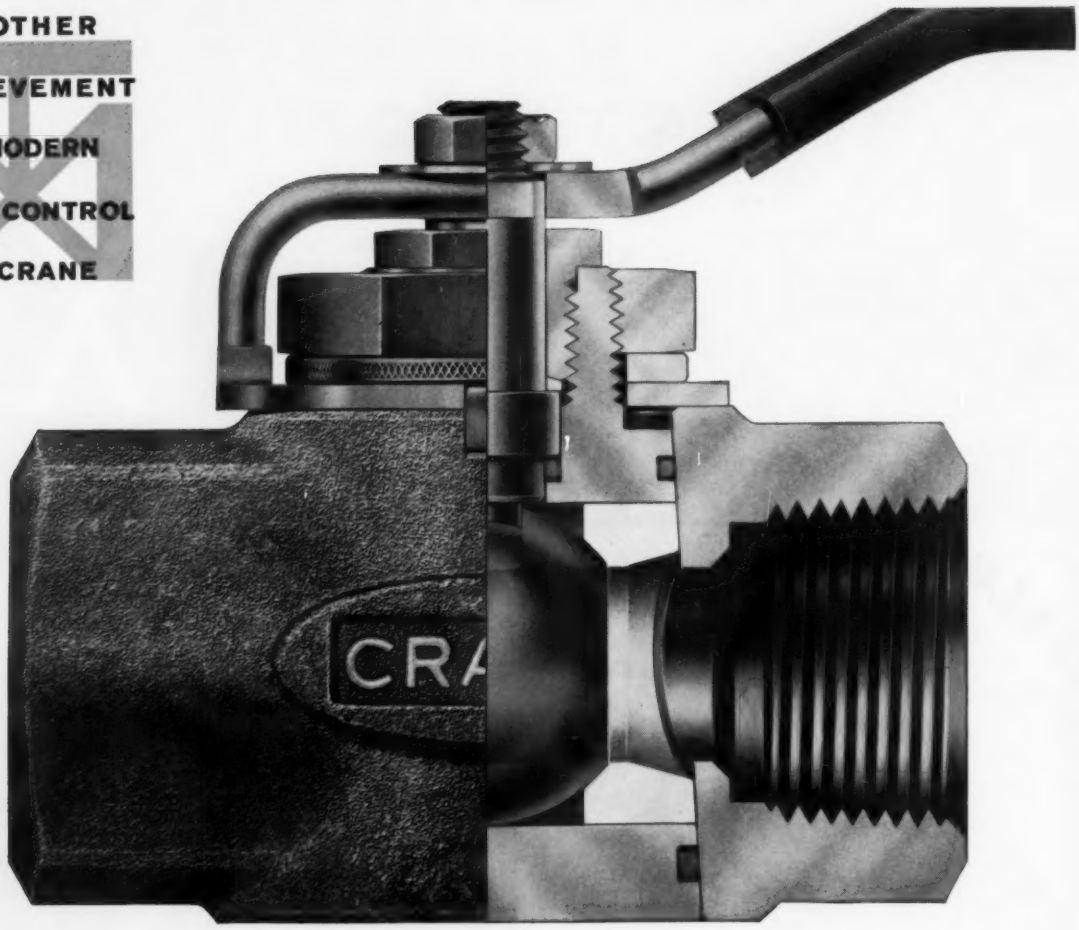
TYPE CB BELT DRIVE
CENTRIFUGAL VENTILATORS



TYPE P PROPELLER ACTION
POWER VENTILATORS

OCTAGON VENTILATOR MFG., CO.
P.O. Box 1127 Jackson, Tenn.

ANOTHER ACHIEVEMENT IN MODERN FLOW CONTROL BY CRANE



this ball beats all!

CRANE BALL VALVES are engineered for superior flow control and minimum-maintenance operation. The secret of this valve's all-around outstanding performance is its beautifully simple, Crane-designed tapered cartridge containing all the working parts. While the valve body remains in line, acting as a pipe connection, the entire cartridge may be removed from the bottom, quickly and easily, for fast exchange or simple, low-cost maintenance.

Precision pre-loaded Teflon* seats assure bottle-tight closing in either direction with a quick, easy quarter turn of the bright, Crane orange insulated handle. The self-aligning, precision machined ball is polished and chrome-plated to reduce friction and wear on the self-cleaning seats. All steel parts are plated for corrosion resistance. Crane Ball Valves handle fluid, gas and air services from vacuum to 800 psi and temperatures from –40 to 400F. Available now from your Crane Distributor for prompt delivery–sizes from ¼" to 2", screwed ends, in bronze, carbon steel, and Type 316 Stainless.

*Registered DuPont trademark.

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CRANE

valves
piping • electronic controls
plumbing • heating
air conditioning

Contact your Crane Distributor or write: Crane Co., Industrial Products Group, 4100 S. Kedzie Ave., Chicago 32, Ill., for illustrated brochure ADB 1001 with complete information on Crane Ball Valves. In Canada: Crane, Ltd., 1170 Beaver Hall Square, Montreal.

EQUIPMENT DEVELOPMENTS

Cast Iron Boilers Available in 29 Sizes

Rated from 2880 to 23,850 sq ft water, and from 1800 to 14,913 sq ft steam, I-B-R ratings. AGA approved for all gases. Inputs vary between 720,000 and 5,760,000 Btu per hr. Burners are ribbon-type, high capacity herringbone design in stainless steel. Base is steel; sections are corrosion resistant cast iron, tested for 50 psi working pressure. Sections tested at 80 psi available on special order. Send for literature. — *Burnham Corp., Heating & Cooling Div., Irvington, N.Y.*

Two-Fan Air Movers Have Up To 35,000 Cfm Capacities

Horizontal/vertical units available in models with 500 to 35,000 cfm capacities. Fans are forward curved, didw, with cast iron center hub. Motors are positioned inside the unit; a large full-entry door allows easy access. Coils and filter frame may be added externally to the unit in the field. A variable pitch motor drive is provided on motors rated up to 7½ hp. — *Drayer-Hanson Div., Hi-Press Air Conditioning of America, Inc.,* 3301 *Medford St., Los Angeles* 63, *Calif.*

Steam Superheater Rated At 1,000,000 Btu Per Hr

Separately fired steam superheater features automatic operation, pneumatically operated temperature control, and electronic outfire control protection. Conforms to ASME requirements, is UL approved, and Hartford inspected. Packaged unit for design temperatures to 1000 F with stainless steel heat exchanger surface and to 600 F with alloy steel heat exchanger. Gas or oil fired units are available. Send for bulletin No. 4038. — *Vapor Heating Corp.,* 80 *E. Jackson Blvd., Chicago* 4, *Ill.*

Water Chilling Systems Powered by Natural Gas Engines

Centrifugal water chilling systems available in 29 models with capacities from 90 to 600 tons. Feature automatic pre-rotation vane control. Safety control system includes a safety device to prevent engine-overload. Units also feature an auxiliary oil pump that permits the engine to idle whem "warming-up." — *York Div. of Borg-Warner Corp., York, Pa.*

Industrial Gas Burners Have Capacities to 3 Million Btuh

"PX" series burners range in sizes from 1000 to 3,000,000 Btu per hr input. Incorporate a method of proportioning all combustion air required independent of varying stack draft. Constructed from heavy duty pressed steel. Send for additional information. — *Roberts-Gorden Appliance Corp.,* 44 *Central Ave., Buffalo* 6, *N.Y.*

INFORMATION on capacities, dimensions, applications, and special features in each item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details.

Other Departments . . .

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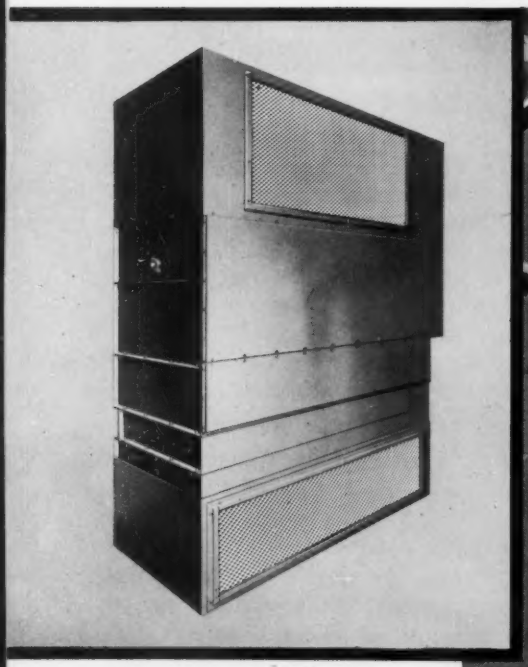
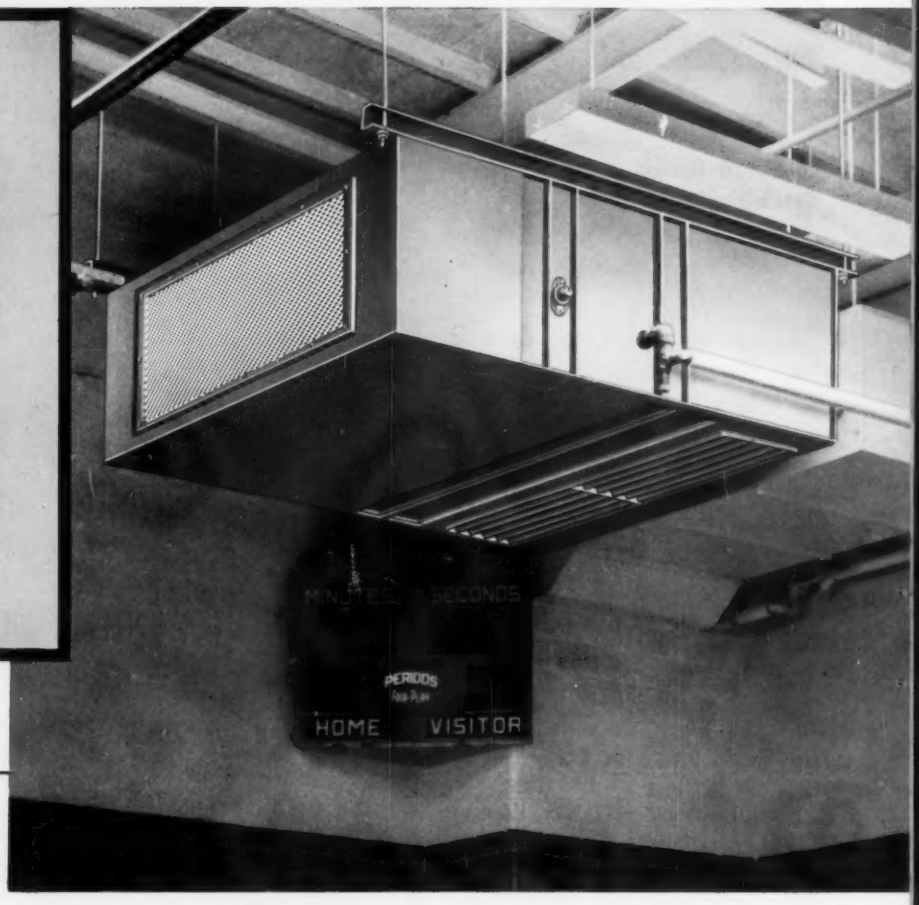
Now—17 Trane Torrivent large area heating-



Two-fan unit. Vertical floor-mounted or wall-hung unit with de luxe discharge plenum and intake box.



New Auditorium Torrivent (*horizontal*). Used in factories, auditoriums, convention halls, gyms, etc. Extremely quiet, economical to operate.

Expanded size range lets you choose a unit that fits your job exactly

Now from the TRANE Torrivent line you can select the capacity you need to meet the requirements of any large interior space. Thorough testing and rating of the Torrivent as a unit assures accurate capacity ratings.

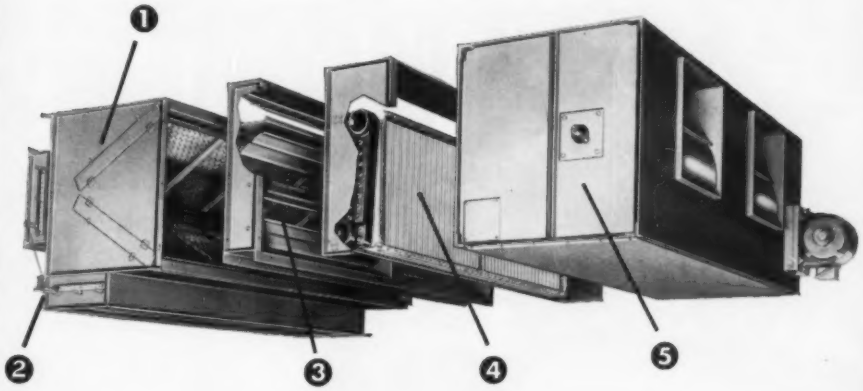
Versatile line. Seventeen Torrivent sizes give you a selection of heating capacities that range from 20,000 to 3,800,000 Btu. Choice of six models—vertical floor; horizontal ceiling; inverted ceiling; horizontal floor; vertical wall; inverted wall—with one to three fan units delivering from 600 to 54,000 cfm.

Sectionalized construction. You get the benefit of sectionalized construction that permits flexible use of any of the matched components and accessories. This is why Torrivent is a highly flexible line—adaptable for more applications.

Exclusive coil design. New TRANE NS Steam Distributing Coil with exclusive Kinetic Orifices and 1″ OD tubes assures even temperature distribution across entire coil face.

Find out more. Ask your nearby TRANE sales office for complete facts on the Torrivent line. Or write TRANE, La Crosse, Wisconsin.

sizes to solve more ventilating problems!



1 Combination filter-mixing box. Mixing box damper blades set to direct two streams of entering air on a merging course—reduces stratification. All air is thoroughly filtered.

2 Ball-joint damper linkage. Nonbinding, prelubricated ball-joint damper linkage is used on all face-and-bypass and mixing box sections. Absorbs minor misalignment and stress. Requires little maintenance.

3 Face-and-bypass dampers. Internal face-and-bypass section uses opposed blade dampers for accurate temperature control. Blades are locked securely and permanently positioned on splined rods which rotate on rustproof, permanently-lubricated nylon bushings. Moving from fully closed to fully open, relative position of blades will not vary.

4 Heating coil. New TRANE Sigma-Flo Coil assures greater effectiveness in heat transfer. Turbulent action on fin surface prevents buildup of any insulating film of air. Steam distributing coil design with 1" OD tubes virtually eliminates condensate bridging—protects against freeze-up. One row of tubes meets most capacity requirements.

5 Fan section. Fans have low outlet velocities for smooth operation. Every fan section balanced electronically after complete assembly—assures efficient, quiet operation.

Torrivent design assures lower operation and maintenance costs

Low operating cost. Torrivent fans, manufactured by TRANE, have an advanced design that assures peak operating efficiency. Fan horsepower requirements are kept low for economical operation. TRANE also offers a wide selection of sizes and unit combinations—so you don't pay for operating unneeded capacity.

Low maintenance cost. All coils are removable and accessible. Coils are pitched in every unit to give complete drainage.

Ball bearings are lubricated for life. Reduces maintenance—eliminates danger of improper lubrication. Bearings selected for a service factor of 3.

Rugged construction. Casing and accessories are uniframe construction, with heavy gauge phosphatized steel. Coils have heavy semi-steel cast headers with tubes rolled and bushed for longer life.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

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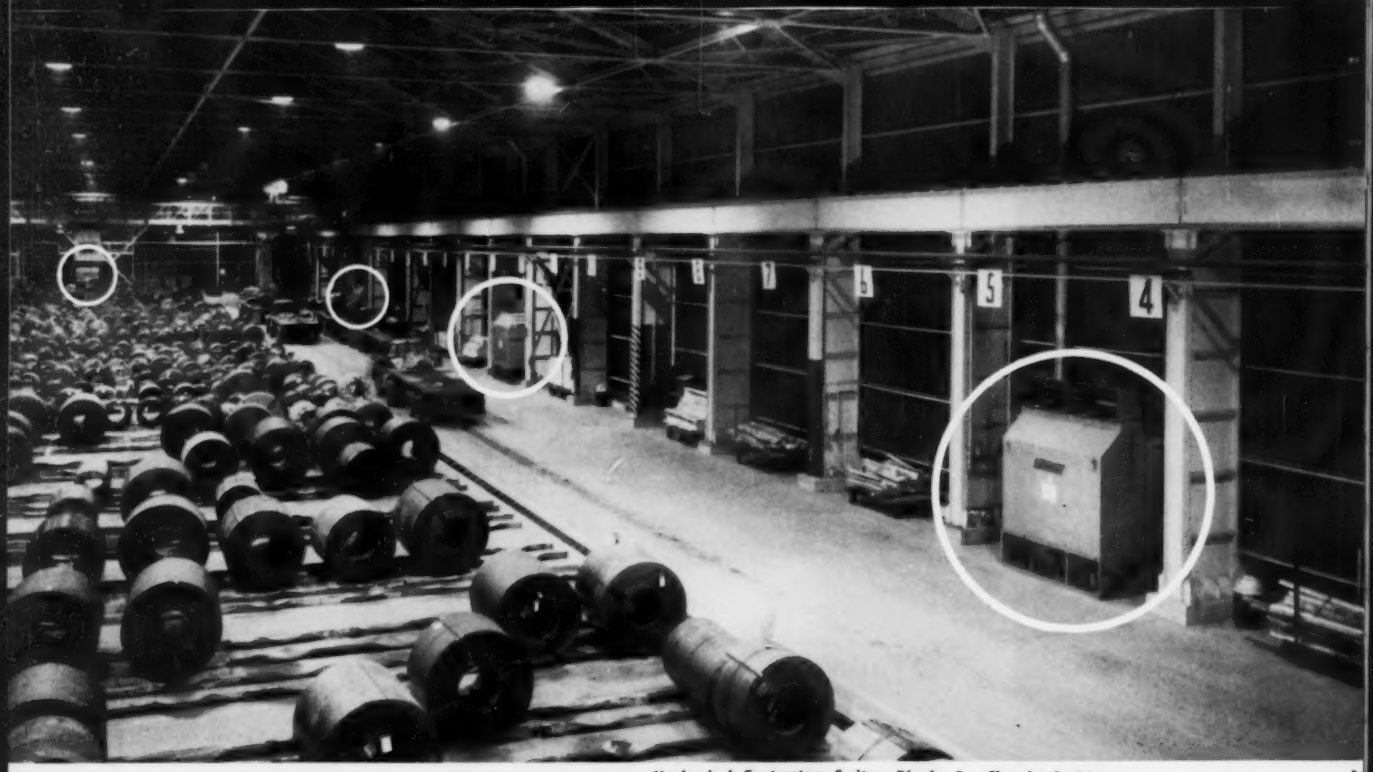
livering from 600 to 54,000 cfm.

Or write TRANE, La Crosse, Wisconsin.

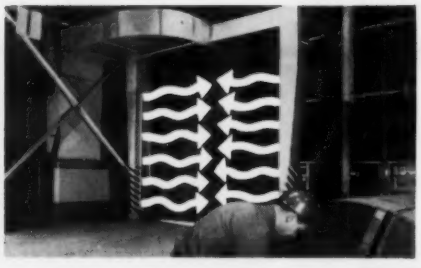
another LENNOX installation

DESIGNED TO DO MORE THAN JUST HEAT AIR



Mechanical Contractor: Switzer-Dipple Co. Cleveland, Ohio

Lennox industrial systems provide complete comfort including ventilation, make-up air, fresh air and cooling



How to eliminate "open door" drafts

Expensive and undesirable drafty areas are created by outside doors which open frequently. (18° air, moving at 15 m.p.h., cools hands and faces just as much as still air at −40°.) Such conditions are intolerable to workers, cuts productivity. This company's engineers solved the problem inexpensively with "door heaters" as pictured. Ducts from the Lennox heater release jets of warm air to blanket the door opening. Cold air is tempered before it can affect workers.

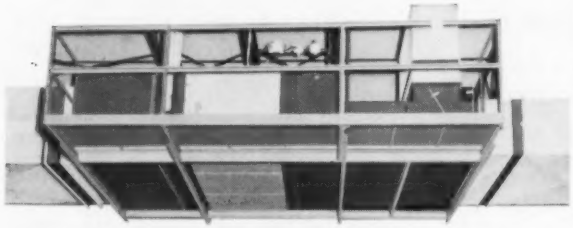
Most industrial buildings, such as the Jones & Laughlin storage and shipping building pictured above, can be expensive to heat. Some heating systems simply "dump" heated air into the working area of these buildings, and others attempt to heat "spots." These systems waste heat, cause drafts, create "hot heads and cold feet," and many times high ceiling temperatures. Lennox industrial heaters overcome these faults. Large capacity blowers and low internal resistance of the heaters make it possible to discharge large volumes of high velocity air *above* the heads of the workers. This produces complete air distribution, eliminating hot spots and uneven temperatures. These units are designed to supply fresh air ventilation and make-up air as required. Cooling equipment can also be added to each of these heaters to provide complete air conditioning. If you would like to receive more information about the Lennox line of industrial heating and cooling equipment, write LENNOX, 621, S. 12th Ave., Marshalltown, Iowa.

LENNOX: A Single Source for Heating, Ventilating and Air Conditioning

tubes rolled and bushed for longer life.

Ductless installation in 102,000 sq. ft. food warehouse kept initial costs down... Lennox efficiency cuts operating costs

This company had previously used conventional suspended unit heaters, but switched to Lennox direct-fired heaters to get more even heating and tempered fresh air for ventilation. Three highly efficient Lennox units now heat and ventilate the entire area of the warehouse, with a minimum temperature differential throughout the building.



You can heat, cool or ventilate any existing building with Lennox equipment

The complete line of Lennox equipment, and your Lennox representative will make your designing and buying job easier . . . providing one central source for direct-fired heaters with up to 2,000,000 Btuh capacity, and cooling and ventilating for any job.

Don't be satisfied with less than

LENNOX

Heats • Cools • Treats and Moves Air

IN HOMES IN CHURCHES IN SCHOOLS IN BUSINESS IN INDUSTRY

LENNOX Industries Inc., est. 1895 — Marshalltown, Ia.; Columbus, O.; Syracuse, N. Y.; Decatur, Ga.; Ft. Worth, Tex.; Salt Lake City, Utah; Los Angeles, Calif. LENNOX Industries (Canada) Ltd.—Toronto, Montreal, Calgary, Vancouver, Winnipeg.

EQUIPMENT DEVELOPMENTS

Continued

Thermistor/Thermocouple Combines Multi-Point Temperature Control with Central Indication

Combines continuous process temperature control at various locations with indication at a central point. Consists of three main elements: probes, thermistor controls, and potentiometer indicator. Thermistor circuits and thermocouple circuits operate independently of each other. Send for bulletin TMISH. — *Atkins Technical Inc.*, 1276 *W. Third St., Cleveland* 13, *Ohio.*

Extruded Aluminum Directional Diffuser Available in Five Frame Styles

Type "D" unit is available in five frame styles and 14 core patterns. All cores are removable and interchangeable. Square and rectangular designs include one-way flow, two-way opposite flow, three-way flow, and two-way corner flow. Comes with snap-in, bevelled, drop collar, flange, and lay-on frames. Send for additional information. — *Waterloo Register Co., Inc., P.O. Box* 147, *Waterloo, Ia.*

Pre-formed Pipe Band Simplifies Fabrication of Jacketed Angles

Allows field fabrication of aluminum-covered elbows, turns, sweeps, and bends directly from straight lines for jacketed pipe insulation. Developed for firm's "Metal-On" system of insulation that consists of "Thermobestos," an isolation barrier, and a weatherproof aluminum covering. Available for use with pipe sizes from ¾ in. up to 24 in. Send for additional information. — *Johns-Manville Corp., Insulation Div.*, 22 *E. 40th St., New York* 16, *N.Y.*

Extruded Aluminum Penthouse Handles Ventilation Through Roof

Pre-fabricated air intake or air exhaust unit for handling ventilation through the roof. Louver blades extend continuously around all four sides with corners mitered and welded. Any size available from 2 by 2 ft on up. Send for descriptive literature and catalog. — *Construction Specialties, Inc.*, 55 *Winans Ave., Cranford, N.J.*

toasting

Continuous, automatic drying with air at precisely controlled temperatures up to 1000°F (for example, continuous toasting of cereal and other food products) is one of many processes in which Kathabar engineers are unusually experienced in the handling of both the air and the product.

drying

Continuous drying of heat-sensitive products (glue and gelatin, for example) is readily accomplished with Kathabar® equipment, using very dry air to remove moisture rapidly under precise control. Kathabar systems reduce cooling requirements, end condensation problems, operate continuously with low maintenance.

cooling

Continuous delivery of sub-freezing air down to extremely low temperatures, without frost or recycling, is one of Kathabar's unique capabilities, whether the air is for storage, testing, or processing. Data on Kathabar equipment for toasting, drying, or cooling is available promptly.

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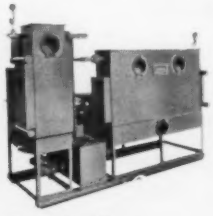

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company .....

street .....

city .....*zone* .....*state* .....

EQUIPMENT DEVELOPMENTS

Continued

Stainless Steel Ball Valves For Corrosive Applications

Type 316 stainless steel ball valves have "Teflon" or "Buna-N" seats for corrosive fluids or gases. Temperature range is from −20 to 400 F with "Teflon" seats, and from −20 to 220 F with "Buna-N" seats. Available in sizes from ¼ to 2 in. Features top-entry design, self-aligning ball, straight-through flow, quarter-turn operation, and leak-proof performance. — *The Lunkenheimer Co., P. O. Box 360, Annex Station, Cincinnati 14, Ohio.*

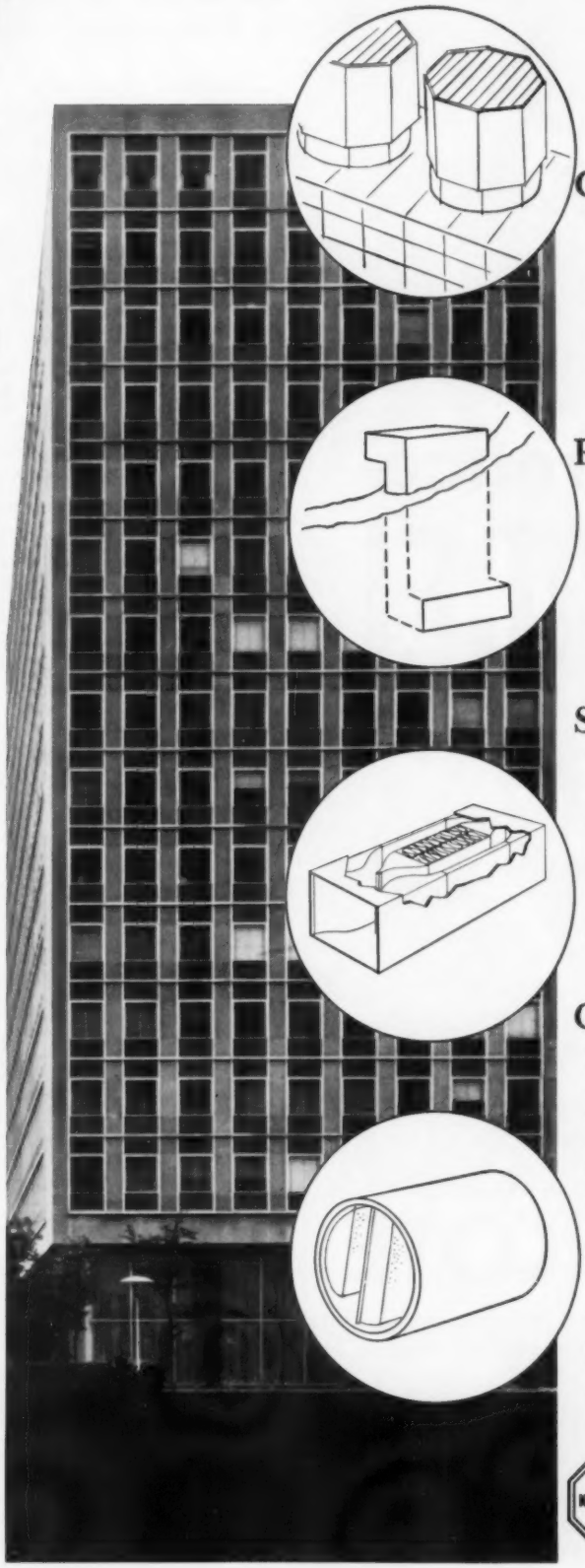
Plastic-lined Metal Valve Controls Corrosive Fluid Flow

"Y" type valve has all wetted or inner parts and surfaces protected by a heavy plastic lining. Three plastics available. Valve bodies made of cast carbon steel, but are available in other alloys. Sizes available from 1 through 3 in., with dimensions conforming to ASA Standard B16.5 for 150 psi service. Will handle temperatures up to 350 F, depending on plastic lining selected. Send for literature. — *The Wm. Powell Co., 2525 Spring Grove Ave., Cincinnati 22, Ohio.*

Power Gas Burners Are Controlled Electrically

A 20-sec pre-purge period clears the combustion chamber of any unburned gases, and establishes a positive draft before opening the gas valve. Immediate shutoff is provided in case of power failure. Units available in capacities from 70,000 to 400,000 Btu per hr. Fired by mixed and natural gases, and are flanged mounted. — *Adams Mfg. Co., 1530 St. Clair Ave., Cleveland 14, Ohio.*

From basement to roof top...Aircoustat® silences noise



Cooling Tower Silencers

Water, fan and air noises are eliminated by Aircoustat Cooling Tower Silencers. Basic elements include intake sound proofing as well as exhaust mufflers. Because every building's requirements are special, every system is individually designed.

Return Air Vent Silencers

Block voices and other noises transmitted through transfer grills. Aircoustat Return Air Vent Silencers trap sound but not air. Available in three configurations and six stock sizes. Adaptable to a variety of installations—doors, walls, ceilings, etc.

Standard Duct Silencers

These low-cost, pre-engineered units assure a lifetime of trouble-free, maintenance-free service. Pre-determined values eliminate guesswork, *guarantee* the right attenuation. More than 60 stock models, fabricated in six lengths, available "off the shelf." No local job adjustments, no fabrication.

Circular Silencers

High velocity air system sounds need not be excessive if proper consideration is given to attenuation. An Aircoustat Circular Silencer adjacent to the fan does the job. Designed especially for higher pressure systems as well as for standard cylindrical ductwork. A full range of standard sizes available.

Selecting performance guaranteed AIRCOUSTAT *units is quick and accurate. We'll be pleased to supply you with complete technical and ordering information on any or all silencers in the line. Write:* KOPPERS COMPANY, INC., *3309 Scott Street, Baltimore 3, Maryland.*

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Engineered Products Sold with Service

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Silvercel, the unique duct insulation, retains its rated on-duct insulation value even when drawn tightly around the duct! This is due to Silvercel's surprising "Fight-back."

Silvercel is an extra-tough, fiber glass insulation. Its "fight-back"—or resiliency—is gained from the unique combination of textile and flame blown fibers in Silvercel. When combined with Silvercote's exclusive RRVB facing, Silvercel's already high insulation value is increased by 30%! When coated with Silvercote's exclusive Silver Vinyl, its performance as a duct liner is unexcelled.

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EQUIPMENT DEVELOPMENTS
Continued

Ball Valve Rated For 1000 F Service

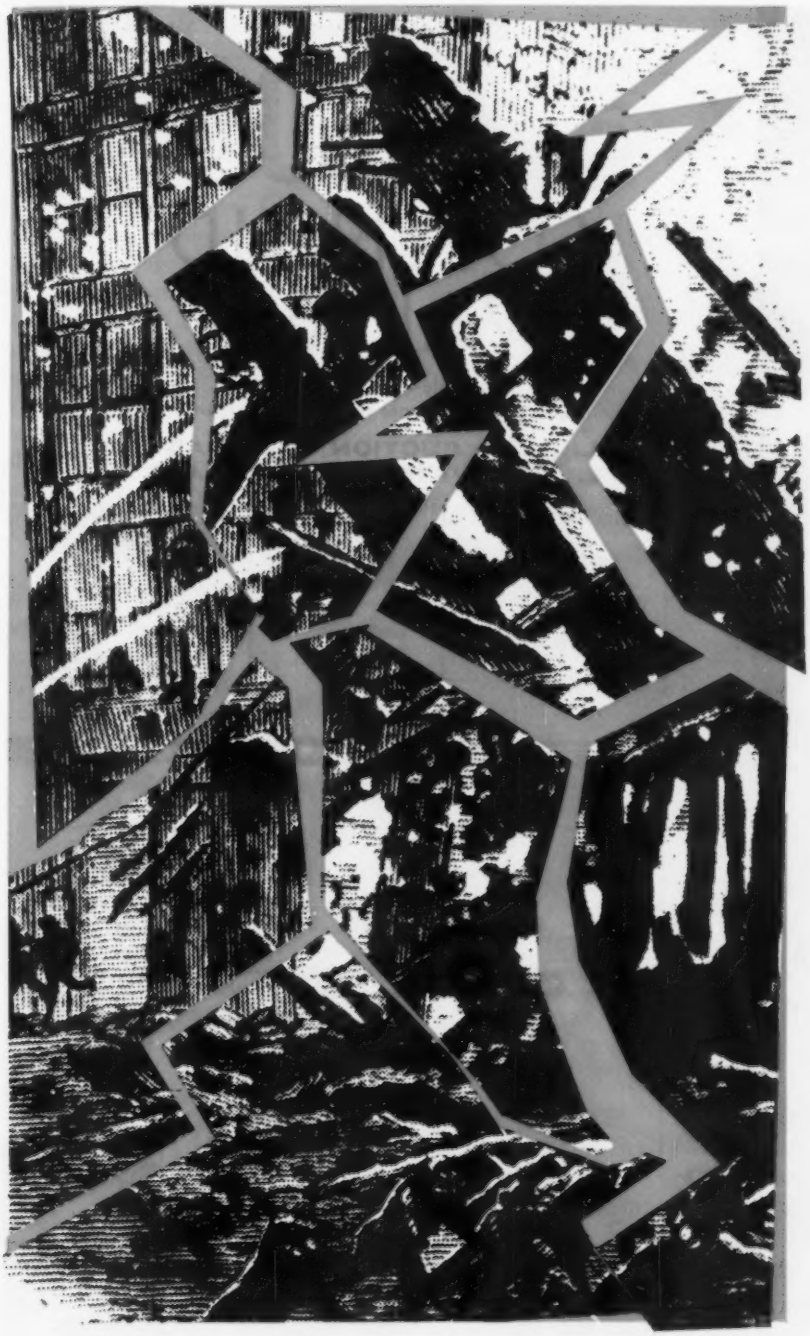
"Graphitar" seats permit use of ball valves at temperatures to 1000 F when handling nonoxidizing liquids or gases, and to 700 F for oxidizing reagents. Allowable maximum pressure at higher temperature is dependent upon the valve body materials. At 1000 F, bodies of 316 stainless steel, 300 lb ASA rating, are suitable for pressures to 355 psig; carbon steel for pressures to 80 psig. Available with screwed and socket weld end connections in 1 through 3 in. sizes, and with 150 lb or 300 lb ASA flanged ends in 1 through 8 in. sizes, either manually or pneumatically operated. — *Hills-McCanna Co., 400 Maple Ave., Carpentersville, Ill.*

Air Cleaners Remove 99 Percent of Dust Particles

Electrostatic air cleaners for "white room" application remove dust particles and air pollutants in excess of 99 percent. Both plate and tube types available in capacities from 100 to 11,000 cfm. Can be customed designed. Particles are removed by the attraction of a powerful electrostatic field. The electrical charging capacity of these units is 7 to 17 kv. — *Research-Cottrell, Inc., Bound Brook, N.J.*

Pumps Available In 20 Sizes

Suitable for cooling towers and other applications. Available with motors ranging from ¼ to 7½ hp. Send for complete engineering data and performance curves. — *Taco Heaters, Inc., 1160 Cranston St., Cranston 9, R.I.*



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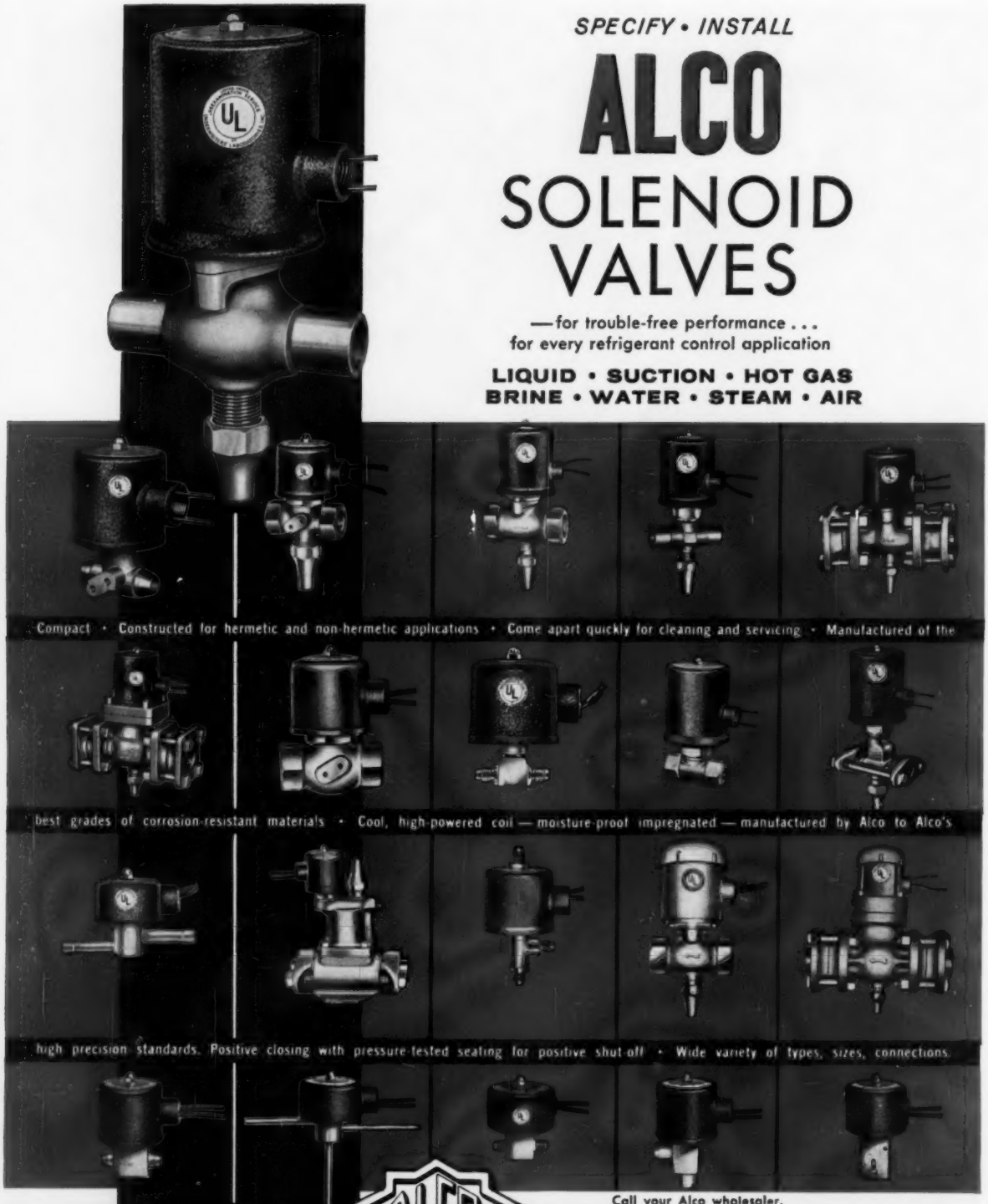

Compact • Constructed for hermetic and non-hermetic applications • Come apart quickly for cleaning and servicing • Manufactured of the best grades of corrosion-resistant materials • Cool, high-powered coil — moisture-proof impregnated — manufactured by Alco to Alco's high precision standards. Positive closing with pressure-tested sealing for positive shut-off • Wide variety of types, sizes, connections.

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The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors
Solenoid Valves • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves

EQUIPMENT DEVELOPMENTS

Electric Device Measures Mixed Air Temperatures

Measures the average temperature of air mixtures consisting of two air streams having variable quantities and temperatures. A variable condition in quantity or temperature distribution of the individual air streams may be represented by an electrical value, the resulting average value of which may be continuously measured through the elements of the circuit arrangement. The result of this measurement may be used to effect a modulating control on the relative proportion of the air streams or on the heat supply system to suit the variable load requirements. Product is patented, but not as yet being manufactured. — *Herman Wald, Electrical Engineer, 23-31 A 29th St., Astoria, L. I., N. Y.*

Injection-Molded Tees For 8 In. UPVC Piping

Injection-molded tees are available for 8 in. unplasticized polyvinyl chloride piping. Recommended working pressure is 75 psi. — *Tube Turns Plastics Inc., 2929 Magazine St., Louisville 11, Ky.*

High Temperature Fans Have Air-Cooled Shafts

Nickel chromium stainless steel fans operate at temperatures up to 1700 F. Air-cooled shafts have integral chamber and slot arrangements which substantially reduce transmission of heat. As the shaft rotates, air is evacuated from the integral chamber through four slotted orifices, creating a heat transfer barrier which keeps shaft cool at all vital bearing points. — *Garden City Fan & Blower Co., 801 North Eighth St., Niles, Mich.*

Dimensioned to your requirements, this new C. H. Wheeler development is the most modern pump available for the chemical, process, heating, ventilating and air-conditioning industries.

BHO End Suction Centrifugal Pumps are offered in 350 Series (stainless steel and corrosion resistant materials) for chemical and 300 Series (cast iron alloys and bronzes) for general process services.

A complete range of 14 pump sizes from 1" to 5" in both series. The size and type you need to do your job. Available for immediate shipment.

Call your C. H. Wheeler representative for full details or write for 12-page catalog and pump design manual.

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Less than 1% Annual Replacement After 25 Years of Constant Service

When you make a study of 50,000 Packless Expansion Joint installations . . . and find average annual replacement *less than one percent*, even after 25 years of constant service . . . you know the answer is *Robertshaw!*

Each leakproof, lifetime joint is built around a Robertshaw Sylphon® "living metal" bellows—designed and built for that specific application.

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Robertshaw-Fulton Controls Company

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EQUIPMENT DEVELOPMENTS

Continued

Control Valves For Low Flows

Regulates the flow of small streams of air, water, steam, or chemical solutions. Available are a lightweight diaphragm-actuated model, a diaphragm model, an ultra-low flow model, and two models having electric actuators. The two electric motor actuators use low or line voltage, and offer two position, floating or proportional control and stroking speeds as low as 7.5 sec. Available in body sizes of ½, ¾, and 1 in. with a selection of materials, body ratings, and both screwed and flanged connections. Send for bulletin B803-1. — *Minneapolis-Honeywell Regulator Co., Valve Div., Fort Washington, Pa.*

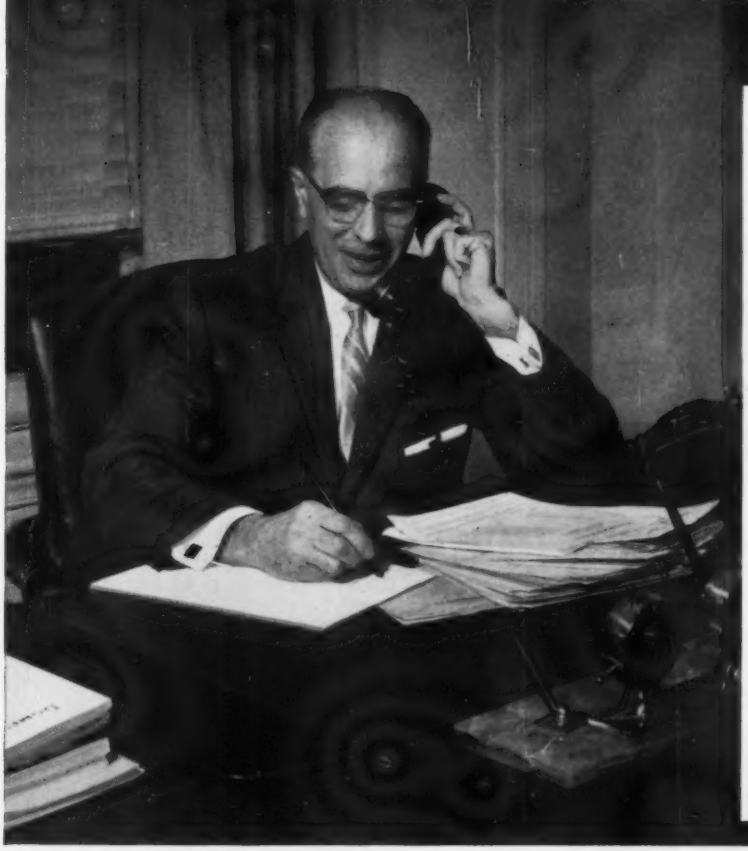
Roof Exhauster Has Low Silhouette

Available as a centrifugal unit or provided with a propeller fan. Features an extruded aluminum louver housing with storm proven louver blades. Straddle bearing design prevents excessive vibration. Motors are air cooled. Capacities range up to 25,890 cfm. Send for bulletin L-61. — *Penn Ventilator Co., Inc., Goodman above Allegheny Ave., Philadelphia 40, Pa.*

Mixing Box Has Single Inlet

Unit delivers a constant volume of air at all times. Temperature control is accomplished by adjusting the ratio of primary to secondary air. This ratio is adjusted by a single control motor, positioned by a temperature sensing element in the controlled space. Send for additional information. — *Barber-Colman Co., Dept. 2321, Rockford, Ill.*

Wheatland Steel Pipe gives you all the superior qualities of Steel plus...*PERSONAL ATTENTION* by top-level Wheatland Personnel



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Wheatland is a company of pipe specialists . . . men who have made pipe their life. Lucas Fiore's 35 years with the Wheatland organization have given him a knowledge of pipe that is difficult to match. And Lucas is constantly striving to give every customer "the best service possible."

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GOODALL *Rubber* EXPANSION JOINTS

Flexible, durable connections for pipe lines and other equipment handling fluids and gases under pressure and vacuum, to prevent excess stresses due to expansion and contraction; to counteract vibration; and to insulate against undesirable sound. Can also be designed to overcome misalignment.

EASIER TO INSTALL—on new equipment or as replacements. Light in weight, with short face-to-face dimensions. Metal retaining rings quickly aligned and bolted. No gaskets required.

LONGER SERVICE LIFE—no embrittlement or corrosion. High resistance to abrasive wear.

STYLES, SIZES AND PRESSURES TO MEET ALL REQUIREMENTS

GOODALL *Rubber* ABSORBER UNITS

Easily installed units engineered to "absorb" vibration, water hammer and other undesirable sound, or where lines are subject to corrosion, abrasion or electrolysis. Light in weight yet exceptionally tough and durable. Installed with two male couplings or molded rubber flanged ends with split steel flanges. Hose can be furnished plain or with built-in wire reinforcement, for suction or discharge.

SPECIFICATIONS: Acid- and abrasive-resistant rubber tube; abrasion- and weather-resistant cover; sizes 1½" through 12" I.D., in lengths of 12", 18", 24", 36" and 48".

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EQUIPMENT DEVELOPMENTS

Continued

Room Air Conditioners Have Concealed Air Outlets

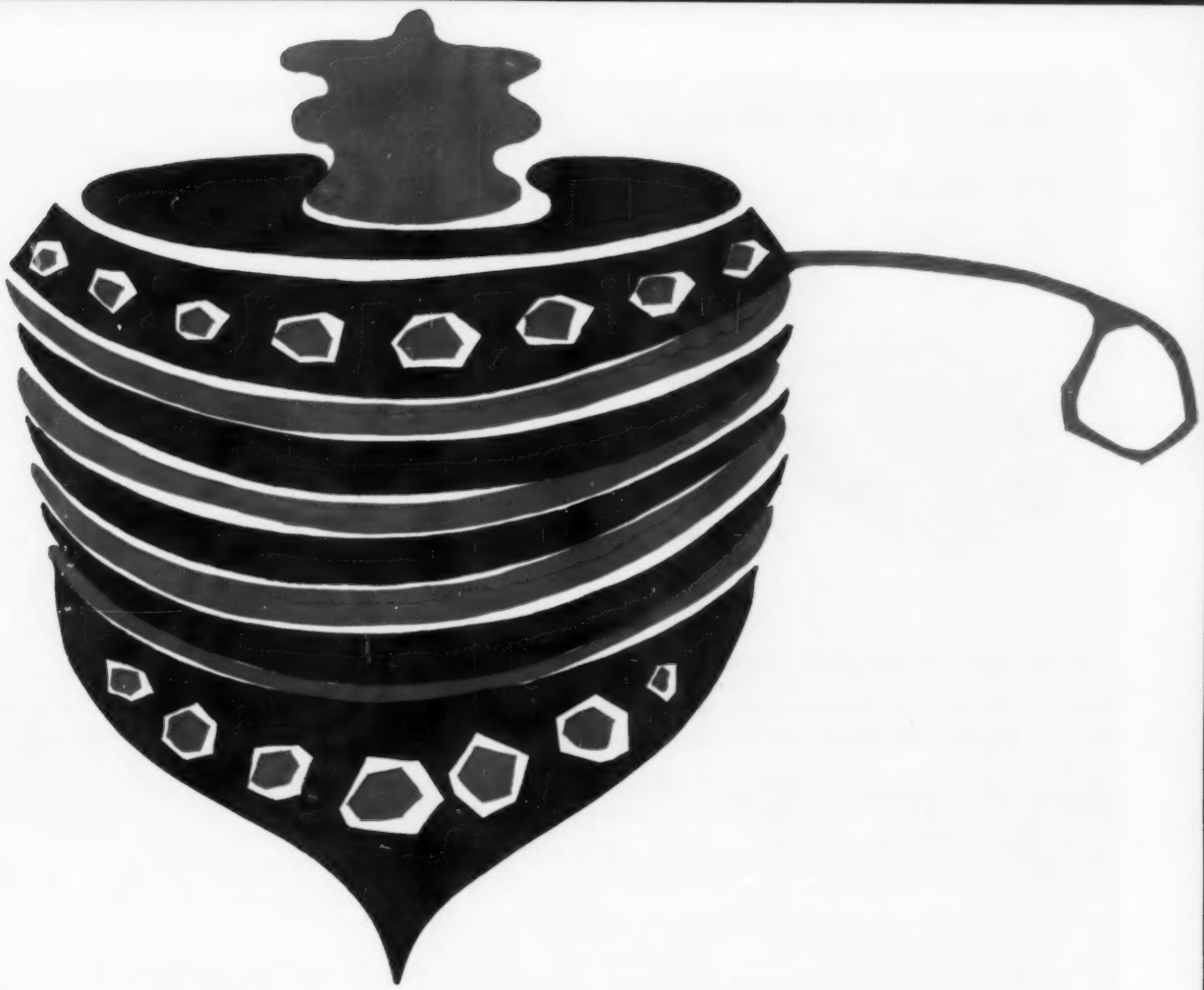
Induction units have a front panel that is unbroken by recirculated air grille work. Secondary air is drawn in through a concealed opening in a kick space under the unit. Outlet grilles are concealed in the cabinet top. Vertical cabinet models are 6 in. deep and 24 in. high, including a 4 in. kick space; low vertical cabinet models are 9 in. deep and 12 in. high. Cabinets can be joined together for wall-to-wall installation. Ten models, eight nozzle arrangements, five unit sizes, and three coils are available. — *The Trane Co., La Crosse, Wis.*

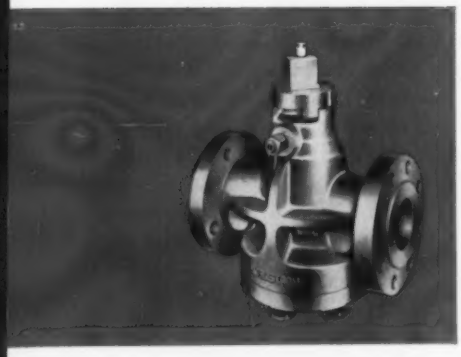
Cooling Water Treatment for Medium and Small Installations

Four cooling water treatment products in briquette form consist of a combination of polyphosphates, selected organics, and inhibited dry acid for control of scale, corrosion, and alkalinity. Send for bulletins C-303, 323, 324, and 325. — *Dearborn Chemical Co., Merchandise Mart, Chicago* 54, *Ill.*

Steam, Hot Water Preheater For Air Conditioning Systems

Offers close temperature control, virtually no stratification, and protects against freezeup. Tubes are individually and readily replaceable. Can be used as a heater in outside air supply and other systems with no preheat unit. Uses an integral face-and-bypass damper system for temperature control. Available in 11 sizes for installation in ducts from 3 to 48 sq ft in cross-sectional area. — *L. J. Wing Mfg. Co.,* 2300 *N. Stiles St., Linden, N. J.*





easy to turn: The longest time in the world can be the time it takes to close a valve . . . when you have to close it in a hurry. The sure, easy quarter turn closure of Rockwell-Nordstrom valves saves seconds, even minutes. And you'll save hours of maintenance time on seat replacement with the Rockwell-Nordstrom's sealant system, which replaces the valve's seat from outside. The longer life of these valves—six, eight, even ten times ordinary types—saves days of replacement labor. Add up these times, multiply by the valves in your plant, then again by your labor rate: the result may amaze you. We'll be happy to send you complete information.

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A & A's "Bid-Maker"

L-28 ECONOMY FLOOR DIFFUSER

(4" x 14" size shown)

YOU CAN HAVE "ROCK-BOTTOM" ECONOMY with our L-28 "Bid-Maker" FLOOR DIFFUSER . . . the kind of economy today's low-priced housing market demands in order to be competitive.

YOU SAVE ON MATERIAL because the L-28 costs you less than comparable diffusers.

YOU SAVE TIME because no tools are required for installation. Anyone can place the L-28 over the opening and the job is done . . . no screws or nails are necessary.

YOU OFFER QUALITY all down the line with features that are usually found only in floor diffusers priced considerably higher. Features like free-moving dial damper control, adjustable damper opening stop. The fins of the L-28 are constructed on 1/3 inch centers for minimum "see-through", greater safety and a more attractive appearance. The fins are preset at the factory but can be quickly adjusted on the spot to deliver any air-flow pattern desired.

Why pay more . . . Why offer less?

SIZES AVAILABLE	FINISHES AVAILABLE
2¼ x 10	Beige Prime
2¼ x 12	Brown Metallic
2¼ x 14	Brass Plated
4 x 10	Chrome Plated
4 x 12	
4 x 14	

Ask your local jobber about the new Air-Master Series and get your copy of the new full-color A & A Catalog 60 or write direct to:

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8337 CLINTON ROAD • CLEVELAND 9, OHIO

EQUIPMENT DEVELOPMENTS

Continued

Air Pumps for Use in Vacuum, Pressure, or Gas Boosting Operations

Two models provide vacuum to 26 in. Hg, pressure to 13 psig, and volumes from 12 to 54 cfm. Made of all cast iron housing and rotor, with four sliding vanes which maintain contact with housing by centrifugal force. Equipped with anti-friction bearings, rotary mechanical shaft seals, inlet filter, and automatic oiler. Send for bulletin 5161. — *Leiman Bros., Inc., 102 Christie St., Newark 5, N.J.*

Inside-Screw Small Steel Gate Valve Has Screwed or Socket Ends

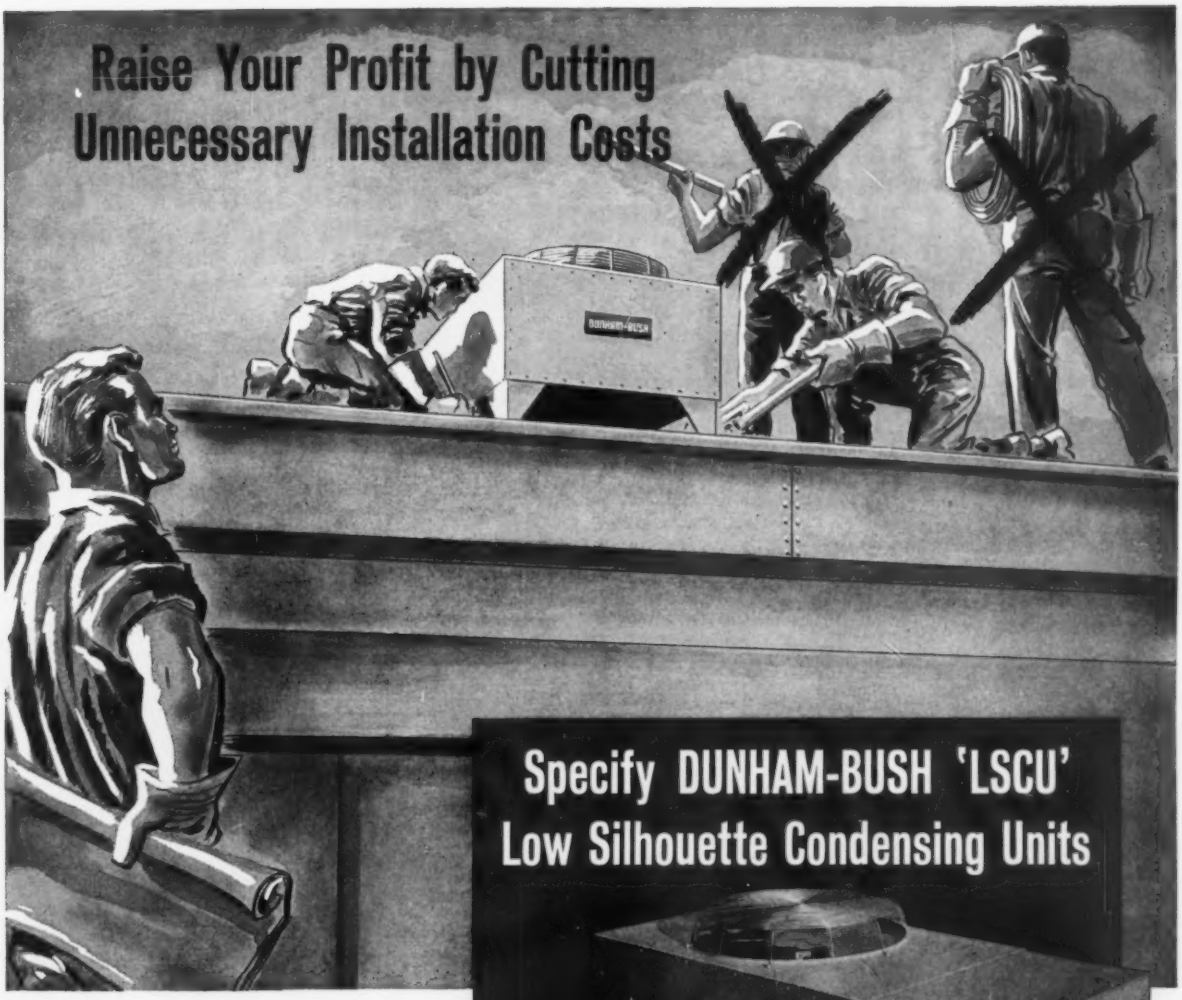
Available in a bolted bonnet design in 1½ and 2 in. sizes, and in a union bonnet in sizes ¼ through 1 in. Features an inside-screw rising stem, solid-wedge disc, and rolled-in seat rings. Rated at 800 psi, 850 F; and 2000 psi, 100 F. Send for literature. — *Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14, Ohio.*

Normally Closed Solenoid Valve for High Vibration, High Pressure Service

Two-way solenoid valves can withstand vibrations at 20-1000 cycles per sec at 10G level without shifting position. Used for normally closed operation at pressures to 1000 psi, valves are supplied in ⅜ in. pipe size with brass body and seat and "Viton A" disc. Handles diesel fuel, kerosene, and gasoline at temperatures from −65 to 150 F. Can be mounted in any position. Send for form No. V5128. — *Automatic Switch Co., Florham Park, N.J.*

Close-Coupled End-Suction Pumps Have Capacities Up To 1600 Gpm

Pumps have capacities up to 1600 gpm with heads to 330 ft. Suitable for air conditioning systems, cooling towers, boiler feed, condenser circulation, and other applications. Optional water jacketed inserts provide for accommodation of hot liquids up to 250 F. Shaft sleeve construction with "O" ring seal provides positive sealing and prevents corrosion. Send for bulletin 108. — *Aurora Pump Div., The New York Air Brake Co., Aurora, Ill.*



...Furnished Completely Packaged...All Piped and Wired

No unexpected extra installation charges when you select Dunham-Bush 'LSCU' Low Silhouette Condensing Units (or 'LRCU' vertical models). Available in five basic sizes, 10 through 30 tons, these completely packaged, ready to install units are specifically designed for air conditioning applications requiring use of water savers.

The 'LSCU' is basically a standard 'LSBC' low silhouette blower condenser, complete with a Brunner-Metic motor-compressor, Heat-X liquid receiver, electrical controls, and refrigeration accessories mounted in a specially.designed section for field attachment or remote installation.

These units can be located anywhere without regard to prevailing winds. The air movement, up and out, means minimum noise ratings and no objectionable air flow toward neighboring buildings.

Request form no. 7017 and 7017-1 for complete data.

DUNHAM-BUSH

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

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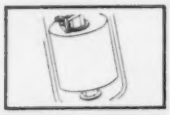
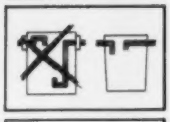
in any steam trap...
IT'S WHAT'S INSIDE THAT COUNTS

Inside
SUPER-SILVERTOPS

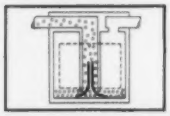


GUIDED BUCKET—Inverted bucket is guided on patented center tube. Results in perfect alignment—no damage to internal parts. Guarantees positive leakproof seating of valve.



NO RESTRICTED PASSAGES—Passages are short, liberal size, clean and smooth bore. Cannot clog with foreign matter. Assure full operating efficiency for trap life.

ANDERLOY VALVE AND SEAT—Eliminates erosive effect of steam. Held in place with clamp and stainless steel screws. Easily removed.



REVERSE FLOW—Bucket remains stationary and the valve open, even during heavy load periods. Stirs up sediment—keeps trap clean.

QUALITY ENGINEERING—The above features of Super-Silvertop Steam Traps are indicative of the outstanding engineering principles employed in the manufacture of all Anderson Steam Specialty products.

Write FOR FREE BULLETIN NO. 26

SUPER SILVERTOPS STEAM TRAPS
BY THE MANUFACTURERS OF Hi-eF PURIFIERS

THE V. D. ANDERSON COMPANY
Division of International Basic Economy Corporation
1949 West 96th Street • Cleveland 2, Ohio

EQUIPMENT DEVELOPMENTS
Continued

Water Processing System For 100 to 2000 Hp Boilers

"Filtrion" for in-plant use on either steam generation, cooling and heating, or process water boilers from 100 to 2000 hp. Removes gases; descales; removes the bulk of turbidity and sediment; prevents carryover; and eliminates corrosion in the boiler, the connecting valves and pipes, and in the system itself. Can be used on all systems up to 300 psi. A single boiler system consists of a pressure vessel for filtering, a chemical feed, an automatic controller, a blowdown analyzer, a recycle pump and tank, and an automatic slurry feed. — *Ster-O-Matic, Inc., Mundelein, Ill.*

14 In. ID Flexible Air Duct for Air Conditioning

Made in 10 ft lengths, available in three types: "57" for general area use; "52" to meet requirements in New York City; and "5J" to meet Chicago requirements. Used as a connector or branch duct on the supply side of central air conditioning systems. — *The Wiremold Co., Hartford* 10, *Conn.*

Oil Preheater for Boiler Applications

Features easily removable and replaceable tube-within-a-tube bundle. Space between the tubes is filled with an intermediate heat transfer and monitoring fluid. If either tube should begin to leak, the boiler is protected by the second tube, and the monitoring fluid will discolor, indicating in a sight glass that the bundle should be changed. Send for additional information. — *Lindy Hydrothermal Products, Inc., 2370 Hoffman St., New York* 58, *N.Y.*

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the centrifugal fans that are built right to do the job right . . . rugged, strong, scientifically engineered

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Compare construction—Compare engineering—Compare delivery dates—and above all Compare capacity and ability to operate under UNUSUAL STRESS—Let your own good judgment decide!

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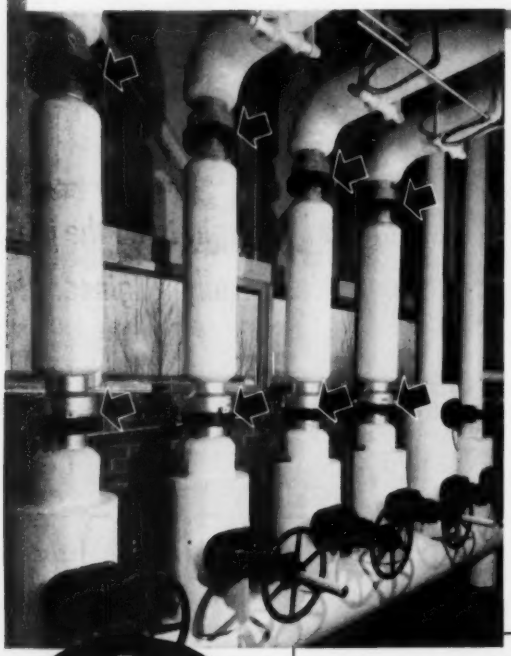
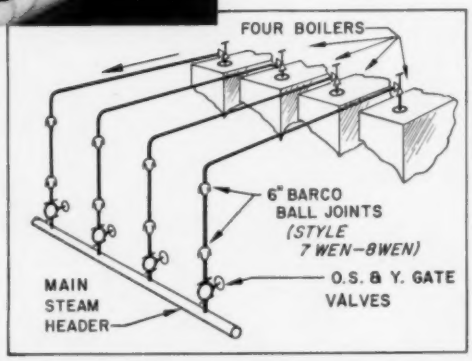
Barco Solves Valve Piping Expansion Problem



Relieves Strain on Valves

This photograph shows an interesting new installation of eight Barco Flexible Ball Joints (see arrows) on four 250 psi boiler steam lines in a West Coast industrial plant. The schematic diagram (below) shows the piping layout.

Due to the fact that operation of individual boilers is intermittent, complicated expansion, contraction, and torsional movements occur in the piping. All of these movements are easily accommodated with the aid of the Barco Joints, relieving reactive forces on the valves.



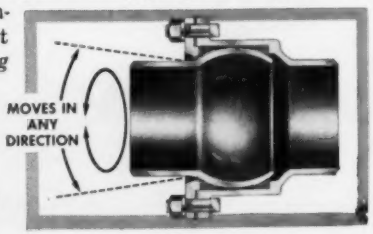
BARCO

BALL JOINTS

1. Handle Expansion
2. Relieve Torsion
3. No "End Thrust"

PROBLEM—Originally, in the plant shown above, it was thought that the "spring" in the long runs of piping would take care of *thermal expansion* and *torsional stresses*. SUCH WAS NOT THE CASE. Serious trouble was encountered, tending to crack valve flanges and twisting so they would not seat tight.

ANSWER—Barco Ball Joints solved the problem, LOGICALLY, SIMPLY, ECONOMICALLY. These rugged all-steel joints have no thin wall sections, no critical points of fatigue, no rubber seals. They are practically indestructible. They provide points of flexibility in piping. Easy to engineer. They fit right in the piping; develop no "end thrust"; require no expensive anchoring. Sizes and styles to meet your requirements. *Send for catalog and information.*



BARCO MANUFACTURING CO.

In Canada: The Holden Co., Ltd., Montreal
541K Hough Street, Barrington, Illinois

EQUIPMENT DEVELOPMENTS

Continued

Noncorrosive Spray Nozzles For Replacement Application

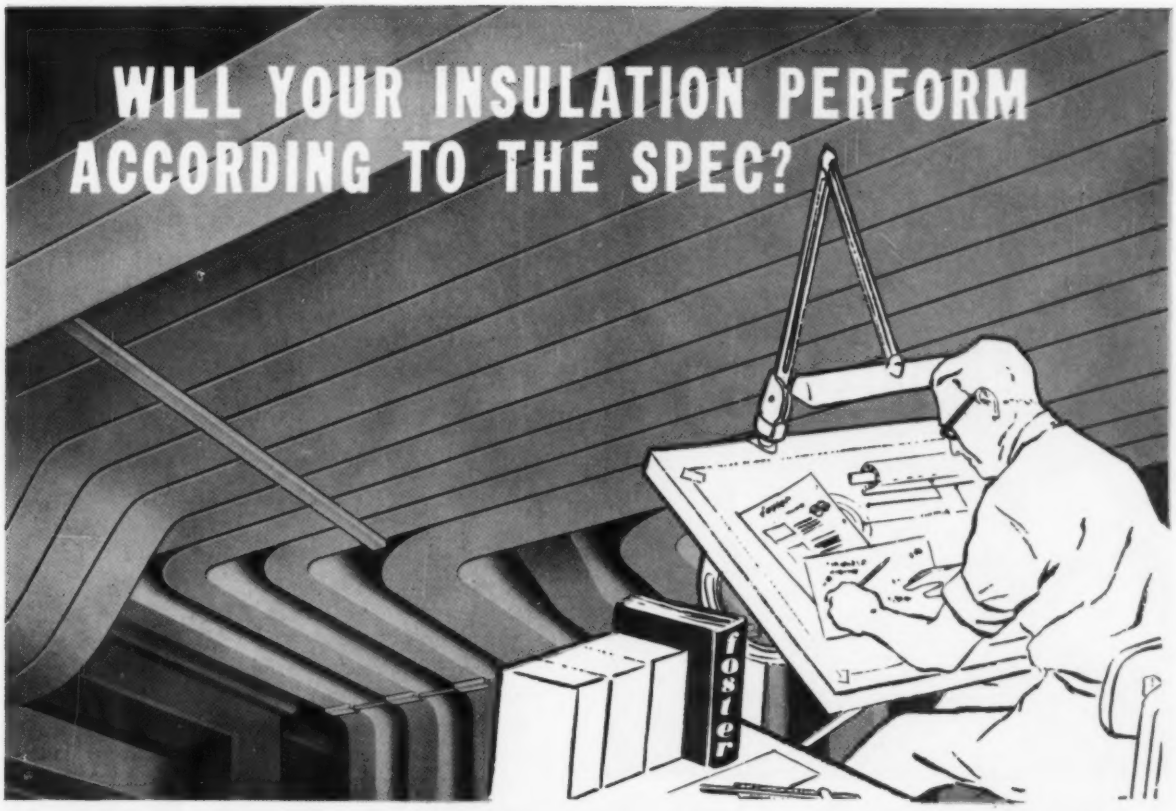
"Tenite" butyrate injection molded hollow cone spray nozzles allow uniform spraying to begin at pressure below 2 psi. Nonporous plastic material resists mineral buildup and withstands above boiling and below freezing temperatures. Seven capacities from 0.8 to 7 gpm and 3/8, 1/2, and 3/4 in. pipe sizes are available to replace nozzles in cooling towers, air washers, evaporative condensers, etc. —*Austin Mfg. Corp.*, 1201 *W. 24th St., Austin* 5, *Tex.*

Plastic Lining Material For Ducts, Tanks

Flexible and elastic plastic sheet material is used for lining ducts, tanks, and other equipment made of steel, wood, or concrete. Resists corrosive attack of many alkalis and acids; also resists abrasion and erosion. Polished surface facilitates solution flow. Supplied in 3/32, 1/8, and 3/16 in. thickness. Send for bulletin. — *Joseph T. Ryerson & Son, Inc., P.O. Box 8000-A, Chicago 80, Ill.*

Adhesive and Coating Bonds Foam to Any Surface

A 100 percent solids material, containing neither water nor solvents, bonds polyethylene, polystyrene, and polyurethane foam to themselves or any other surface. Permanently flexible, non-toxic, and will withstand temperatures of −80 F. Compound has a working time of about 4 hr, and will cure in 8 to 12 hr. Also is used as a sealer and caulking compound. It is odorless, white in color, and waterproof. — *Adhesive Products Corp.*, 1660 *Boone Ave., New York* 60, *N.Y.*



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When the thermal-insulation specification includes the name "Foster," you're assured a protection system engineered to resist practically every condition the insulation can be expected to encounter. And only with the proper protection will the insulation perform efficiently.

There's no such thing as "or equal" when it comes to protecting your costly investment in insulation. Only the Foster system in the specifications can be relied on 100% to fill the bill.

Foster insulation-protection research has developed adhesive, vapor-barrier, and coating systems to meet virtually every conceivable thermal-insulation requirement. A letter or call outlining your problem will bring one or more Foster Bulletins which should contain an appropriate solution.

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SPECIFY foster 30-02

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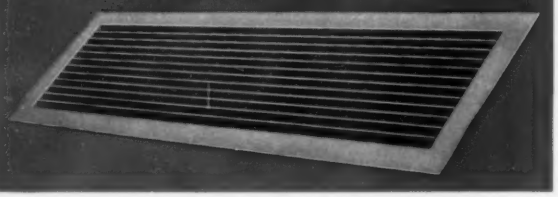
"Fabrikated"
SOLID STEEL BAR
WALL GRILLE
New Linear Design



No. 331 WG

This new "Fabrikated" design wall grille has 14 gauge (.083) horizontal bars ¾" deep. Vertical bars are 14 gauge by ½" deep. All bars are solid steel with rounded (mill) edges. Construction is exceptionally rigid. Free air is approximately 70%.

Recommended for ceiling, wall, and sill window installations for continuous design effect in schools, hospitals, banks and public buildings where heating, ventilating or air conditioning systems are required.

No. 331 WG design can also be furnished in core style only without rims or borders. Write for Catalog No. 61.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.
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EQUIPMENT DEVELOPMENTS

Continued

Ventilator Units Offered In Powered or Gravity Models

May be used in any position on any flat or pitched roof, on ridge or wall installation. Power unit is equipped with motor and fan for moving large quantities of air under low static pressure conditions where an axial-flow type fan is preferred; or it may be operated as a booster to gravity action. The gravity head may be used to relieve positive pressure conditions. Both units are available with or without integral bases. Send for literature. — *ExitAire Co., P. O. Box 276, 13650 Vaughn St., Pacoima, Calif.*

Infra-Red Gas Radiant Heater For Outside Installation

Heats an outdoor area up to 20 ft in diameter while emitting an attractive bright orange glow at night. Installation can be permanent, such as a gas light, or on a portable base. Fired by natural or propane gas. Stainless steel ceramic-coated heat exchanger attains temperatures up to 1600 F. Input is 50,000 Btu per hr. Manual control has fail-proof safety pilot. Also available for indoor use, AGA approved, with various types of automatic controls. Send for literature — *The Solarflo Co., Inc., P.O. Box 745, Glendora, Calif.*

Field Closure Material For Underground Piping

Mastic colloidal resin resists moisture, weathering, acids, alkalies, and electrolysis. Unaffected by temperatures ranging from sub-zero to 250 F. Coating can withstand severe distortion and bending. Material is brushed on over the welded conduit joint and then a glass-like wrapping material is applied over the coating. A final coating completes the closure. Send for additional information. — *Ric-wiL, Inc., Barberton, Ohio.*

Panel-Mounted Fixed Tachometer Has Three Switch-Selected Ranges

Unit includes a pick-up head and connecting cable. Pick-up head may be located as far as 1000 ft from the indicator unit. Requires approximately 4¾ by 4¼ in. of panel space, plus any location for the range selector switch. Also available in single-range model. — *Metron Instrument Co., 5300 S. Delaware, Littleton, Colo.*

Gives You MORE, Costs You LESS Check all the FEATURES!*

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Multi-Velocity INDUSTRIAL AIR FILTER

FOR HEATING OR AIR CONDITIONING

✶ **ALUMINUM** construction...rust-proof...corrosion-resistant. Eliminates need for expensive, heavy structural design in filter bank construction.

✶ **EASY TO HANDLE** Light-weight permits carrying, washing and installing of many more filters per hour.

✶ **EASY TO CLEAN** Lint and dirt are easily flushed off with water because of water soluble Super Filter Coat (the adhesive with the built-in detergent).

✶ **DEPTH LOADING** Designed to minimize surface loading, with depth loading accomplished through successive layers of slit and expanded aluminum, and varying baffle sizes.

✶ **REMOVES ODORS** Revolutionary R P Super Filter Coat adhesive adds odor removal to the normal dirt-trapping properties of R P Industrial Air Filters —with no increase in resistance—at *no* extra cost!

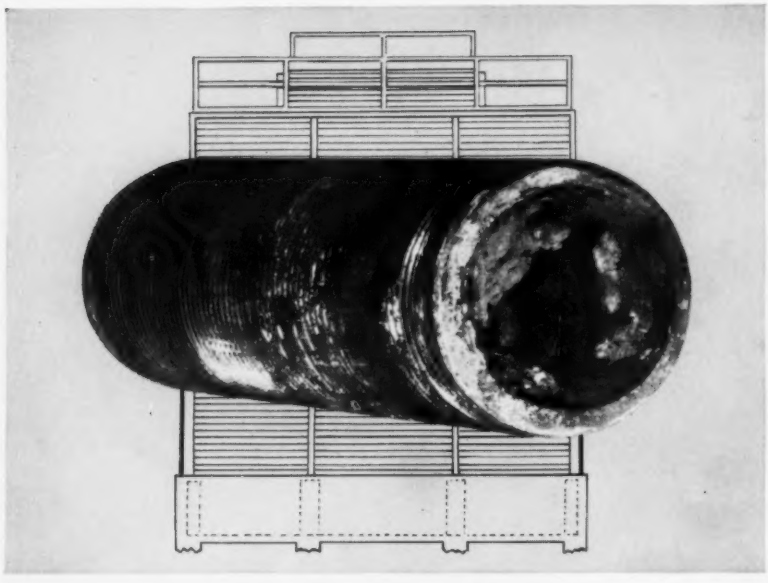
✶ **GERMICIDAL** Super Filter Coat adhesive contains Hexachlorophene, the well-known bacteria destroying agent.

✶ **LOWER RESISTANCE** Unique baffle design permits maximum air passage...more uniform dust collection within the filter depth.

✶ **HIGHER EFFICIENCY** Scientifically staggered pattern of flat baffles sets up a controlled turbulence that centrifuges dust and odor particles onto the adhesive for maximum efficiency.

for information, write RP / *Products of Research*

RESEARCH PRODUCTS *Corporation* Dept. 46-I, Madison 1, Wisconsin



COOLING WATER CORROSION MUST BE STOPPED!

Unchecked scale deposit and corrosion in your air conditioning system can cut its life by years . . . increase maintenance and replacement problems several-fold.

Bird-Archer Series 5900 chromate formulations stop severe scaling and corrosion easily, effectively and economically, adjust pH to safe, neutral ranges. In small systems, treatments are added to the circulating water directly from the shipping container through a specially designed Micro-Feeder, eliminating the necessity for manual, daily chemical feeding. For larger units special chemical feed equipment is available.

Write for Bulletin 117 and the name of the Bird-Archer Service Engineer nearest you.

BA-100

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WATER TREATING CONSULTANTS
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EQUIPMENT DEVELOPMENTS
Continued

Ball Valve Has Non-Scoring Metal-to-Metal Seal

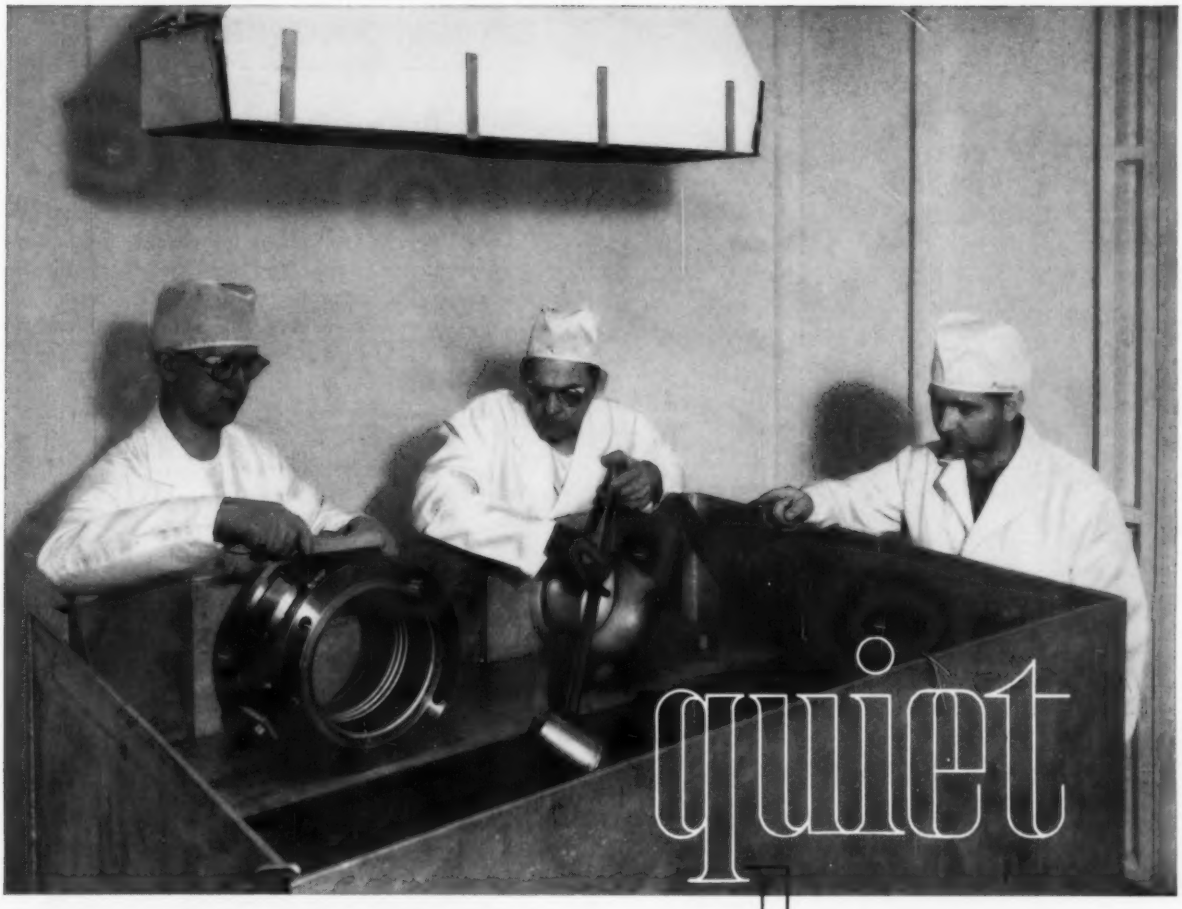
Eccentric cam action of the stem lifts the ball away from the seat before it is turned, eliminating friction and scoring. Permits the use of metal-to-metal seating surfaces, allowing use at high temperature and under radioactive conditions. Full-round flow passage is equal to 100 percent of the pipe area. A locking action insures tight shut-off, even when line pressure is reversed. Available in a wide range of sizes and pressure classes with manual, pneumatic, electric, or hydraulic operators. — *General Kinetics Corp.*, 197 *S. Van Brunt St., Englewood, N.J.*

Axial Blade Ventilators Have Glass Fiber Houses

Nine different units have capacities from 1220 to 4580 cfm at 0 in. SP. Will withstand weather, salt spray, most chemicals, and fumes. Molded-in sky-blue color; never needs painting. Units absorb sound and vibration. Send for additional information. — *Swartwout Fabricators, Inc., Kokomo, Ind.*

Return Air Grille Has Easily Changed Filter

Grille is hinged at the base with a full-length piano hinge and has a frame and filter rack allowing a 1 in. filter to be installed directly behind the grille. The filter and frame are completely hidden. Range of sizes to handle 500 to 2000 cfm. Utilizes one-piece, whistle-free curved louvers placed ½ in. apart and deflected 30 deg. Send for additional information. — *Lima Register Co.*, 1790 *N. Cable Rd., Lima, Ohio.*



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Men in white clean and sterilize Adsco Expansion Joints with steam and detergents, dry, and hermetically seal them in polyethylene bags. At an Air Force Titan missile base, system contamination is less than 25 parts per million, with no particle larger than 150 microns.

Cleanliness of this magnitude reveals the slightest imperfection. The construction of these expansion joints which glisten like diamonds is revealed as not just good, but perfect; one slip could bring disaster.

When special designs and/or services with quality workmanship and dependability are required... call on Adsco.

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Have You Tried a RIDGID® Hex Wrench Yet?

Six Sizes with Maximum Jaw Openings of 1⅛″, 1½″, 1¾″, 2½″, 3½″ and 4⅞″ across flats.

the Perfect Mate for your RIDGID Pipe Wrench!

Finest of All Adjustable Smooth-Jaw Wrenches

MORE GRIPPING POWER... for all nuts. Puts a wrap-around grip on hexes that just won't slip. Because you're pulling with at least three flat sides at once, you'll never round off shoulders. Works on square nuts, valve packing nuts, unions and gas cocks and flat shapes, too. Smooth jaws won't even mar polished or plated surfaces.

RIDGID No. E-110 Offset Hex Wrench

Big Jaw, Short Handle for Sink and Tub Drain Nuts

Maximum Jaw Opening— 2⅝″ across flats.

RUGGED CONSTRUCTION... built good and solid. Thin but extra-strong jaws slip into tight places. The first time you use a hex wrench you'll know that here's a wrench you'll use for a long, long time. It's every bit as rugged as your familiar RIDGID Pipe Wrench.

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Maximum Jaw Opening— 1½″ across flats.

From experience you know it's easier to work with the best of tools. Order your RIDGID Hex Wrenches from your Supply House today!

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EQUIPMENT DEVELOPMENTS

Continued

Thermo Electronic Monitor Scans And Indicates Conditions at 10 Points

Monitors from one to 10 points to be checked for the same value. Applications include monitoring temperature, pressure, flow, and any variable measurable by transducers generating d-c millivolt outputs, or changes in resistance. Available with a null balance potentiometer or bridge type measuring circuit and a 10 point scanning mechanism. Ranges are available for all standard sensing elements. Calibration accuracy is 0.25 percent of full scale span. Operating requirements are 59 to 104 F ambient temperature, 115 v, 50-60 cycle a-c. — *Thermo Electric Co., Inc., Saddle Brook, N.J.*

Flowmeter Calibrator Provides Wide Range of Calibration

Volumetric flowmeter calibrator consists of a pressurized supply tank, test and flow control station, volumetric standpipe and return unit, and a control and recording unit. Can be used for routine calibration of flowmeters or as a research tool in measurement of liquid flow. Unit is effective over wide ranges of pressures and flow rates of liquids. — *System was developed by Rocketdyne, Div. of North American Aviation, Inc., and licensed for production and sale to Norlac Engineering and Mfg. Co., Culver City, Calif.*

Powder Cleaner for Cooling Towers, Evaporative Condensers

Industrial cleaner in dry powder form available in 6 lb tins, and 25, 75, 150, and 400 lb drums. Send for descriptive literature. — *Berman Chemical Co.,* 1705 *N. 12th St., Toledo, Ohio.*

Differential Pressure Gage Rated at 3000 Psi, Has 60 Psi Scale

Has an accuracy of ±2 percent for a temperature range of −40 to 200 F. Has no mechanical linkages; operates by means of a magnetic coupling. Mounting is by line with ¼ in. NPT or AND10050-4 connections, or by sub-plate. Construction materials are aluminum and nickel alloys, with other materials available. Gives a direct reading of tank levels, as well as pressure drops across filters, heat exchangers, orifices for flow metering, and other equipment. — *Pall Corp.,* 30 *Sea Cliff Ave., Glen Cove, N.Y.*

Architects: Sargent-Webster-Crenshaw & Folley **General Contractor:** Joseph E. Bennett Co., Inc. **Plumbing, Heating & Ventilating Contractor:** Northern Mechanicals, Inc.

NINE B&G® BOOSTER PUMPS PROVIDE CONTROLLED COMFORT IN ST. LAWRENCE SEAWAY CORPORATION'S ADMINISTRATION BUILDING, Massena, N.Y.

The forced circulation hot water equipment in this outstanding office building is made by B&G... Booster Pumps, Flo-Control Valves, Airtrol Systems and Reducing Valves.

The building is divided into nine zones for better temperature control, with each zone served by a B&G Booster. A bronze Booster is used for circulating domestic hot water.

Over 3,500,000 Boosters are in service today...clinching evidence that their superior quality and performance has never been challenged. The reasons why they so completely dominate their field are not hard to find. Above all they are *quiet—vibrationless*...the prime essentials of a forced hot water circulating pump. They are dependable and profitable —not a cause of endless service and customer dissatisfaction. Sound design and sturdy construction of best materials assure efficient performance for years.

B&G *Hydro-Flo* Products are made by a company which offers help in any problem of design or installation—and with nation-wide distributors and service organizations.

Hydro-Flo® SYSTEM

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Where people gather...CLEAN PURE AIR is VITAL

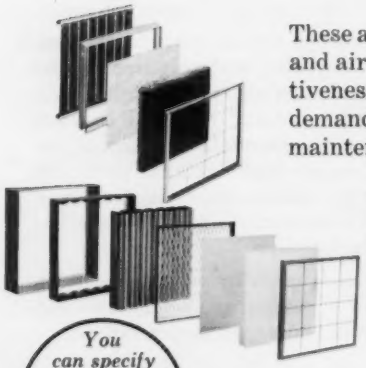
ARCHITECT: Heitschmidt and Thompson, AIR CONDITIONING CONTRACTOR: Air Conditioning Company, Inc. (Southern California), MECHANICAL ENGINEER: J. L. Hengstler

• At The Biltmore Hotel in Los Angeles, an atmosphere of clean, pure air is thoughtfully provided for guests and staff.

In the public areas, where it is necessary to permit entry of large amounts of vitiated outside air, combination replaceable media air filters and total detention type gas and vapor adsorbers by Burke are being used.

In the guest rooms, where 100% of the air is recirculated, combination replaceable media air filters and partial detention type gas and vapor adsorbers are in operation.

ROTOAire® CLEANS AND PURIFIES OVER A BILLION CUBIC FEET OF AIR DAILY IN THE BILTMORE HOTEL!



These are the advance design air filters and air purifiers that deliver the effectiveness, efficiency and dependability demanded by all modern building and maintenance programs.

They are readily adaptable to all new or existing installations.
They are available in a wide variety of sizes.
They may be operated at varying velocities and with various combinations of media.
The initial cost is low, but even more important . . . the maintenance cost is low.

You can specify ROTOAire® PRODUCTS with confidence!

Write for Technical Data Bulletin and "Economic Analysis."

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EQUIPMENT DEVELOPMENTS
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Motorized Globe Valve For Pressures to 150 Psi

Provides zone control of steam or hot water heating systems and other applications. Lifetime-lubricated gear-motor operator opens valve against the rated line pressure without limitations of pressure imbalance. Powered by a continous duty shaded pole motor. Unit automatically compensates for disc wear. Operates uniformly in any position not more than 90 deg from the vertical upright. Range of sizes from ½ up to 3 in., either 32 or 139 sec timing cycle, and in 24, 120, or 240 v models. Send for literature R-1698, R-1709, and R-37-0940. — *White-Rodgers Co.*, 9797 *Reavis Rd., St. Louis* 23, *Mo.*

Mineral Wool Insulating Cement for 2100 F Applications

Dry coverage of high temperature mineral wool insulating cement is 45 sq ft, 1 in. thick per 100 lb. Linear shrinkage after heating to 2100 F is 3 percent. — *Baldwin-Ehret-Hill, Inc., Trenton, N. J.*

Stem Thermometers Available in Four Ranges

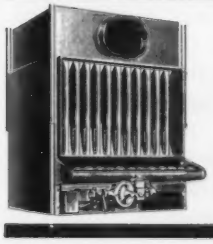
Units have anti-parallax dials, 2⅝ in. in diameter. Bi-metal element and drive rod are silicone dampened to eliminate vacillating readings where vibration is encountered. Ranges available are: −40 to 160 F; 0 to 220 F; 50 to 300 F; and 150 to 750 F. Over-range protection is 50 percent for ranges up to 300 F and 10 percent for the range to 750 F. Accuracy is within ½ percent over the entire scale. — *Pacific Transducer Corp.*, 11836 *W. Pico Blvd., Los Angeles* 64, *Calif.*

how to use duct furnaces for make-up air

Free from Reznor: Learn about this profitable use of duct furnaces along with other valuable information on make-up air in our just published handbook "What to Consider in Designing Make-Up Air Systems."

Manufacturing plants, chemical, food and material processors, restaurants, bakeries and dry cleaners are becoming increasingly aware of the need for make-up air. They now realize that bringing in clean, heated replacement air through a duct furnace can prevent undesirable drafts and the infiltration of dust, dirt and fumes.

Reznor's handbook on make-up air is one of a new series of Reznor Heating Handbooks to help you solve commercial and industrial heating problems. For your copy, published by the world's largest manufacturer of gas unit heaters, fill in the coupon and mail to Reznor. Or, for more information, call your Reznor distributor or nearby Reznor district office listed in the Yellow Pages under "Heaters—Unit."



REZNOR HEATERS

REZNOR MANUFACTURING COMPANY
Dept. HPA-9, Mercer, Pennsylvania

Send me a copy of "What to Consider in Designing Make-Up Air Systems."

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company _____

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which size stack do YOU prefer?

Each does the same job— the smaller one is equipped with a Lehigh Induced Draft Fan

Lehigh Induced Draft Fans are designed to help eliminate large, costly, unsightly stacks. They maintain a *constant* over-fire draft regardless of atmospheric conditions, help keep boilers operating at *maximum* efficiently at all times, and significantly *lower fuel bills* . . . while radically *reducing* the size of your stack.

Rugged Construction—long life: to prevent distortion under elevated temperature conditions, the fan housing, bearing pedestal, motor support and fan wheel of Lehigh Draft Induced Fans are constructed of all-welded integral ⅜" mild steel. A radiant heat cover and an aluminum heat flinger protect the inboard bearing from radiated heat. And because both bearing and shaft are kept to a low operating temperature, the Lehigh Induced Draft Fan makes use of standard, self-aligning ball bearing pillow blocks. *All* Lehigh Induced Draft Fans feature a flanged inlet, flanged outlet, and inspection cover as standard equipment.

If you would like to reduce stack height . . . and gain optimum boiler efficiency . . . contact your local Lehigh Representative today. He'll gladly give you all the details. Or write directly to us for our detailed technical bulletin: 2171 LF-1

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FULLER COMPANY, CATASAUQUA 1, PA.
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EQUIPMENT DEVELOPMENTS
Continued

Standard Heat Exchangers Have "O" Ring Seals

Double "O" ring seal permits the tube bundle to expand and contract without harmful strain or intermixing of shell and tubeside fluids. "O" rings retain compression without adjustment and are unaffected by vibration or temperature changes. Units feature an externally packed floating head. Tube bundles are removable. Shell diameters available from 6 through 16 in. One and two pass models have a variety of nozzle locations, and are assembled from standard parts. Send for bulletin 0-1162. — *Basco, Inc., North Tonawanda, N. Y.*

Air Entrance System Reclaims Warm Air Stream

Packaged product for commercial entrances 4, 6, and 8 ft wide with modular and special sizes available. Directs a stream of air down to a plenum where it is reclaimed and recirculated. Reduces loss of heating or cooling. — *Air Doors, Inc., New Castle, Ind.*

Transducer Has Transistorized Circuitry

Electronically converts temperature into air pressure. Has transistorized circuitry and etched circuit boards. "Mark III" unit can take inputs from up to three different thermostats. Outputs can be sent to pneumatic motors, dampers, and valves. Also can link a pneumatic system to a centralized electronic control center to permit operation of an entire building from one remote source. — *Minneapolis-Honeywell Regulator Co., 2727 S. Fourth Ave., Minneapolis 8, Minn.*

Do you have an answer for Mr. Quibble?

Changing educational patterns demand flexible schools with learning spaces equipped for year-round air conditioning under unitary control— as an economic necessity based upon educational productivity for the life of the building.

Mr. Quibble is a well-meaning school executive.
He believes in air conditioning and would like to have it in his new school.
But he is apprehensive about the opinions of board members and taxpayers.
So he is apt to forego this basic requirement for maximum learning and
build a school that will be sadly lacking through the coming decades.
Only his architect and engineer can show him how to have air conditioning
with proper regard for economy and without sacrifice of beauty and utility.
The revolution in education is bringing a revolution in schoolhouse design
predicated upon a fully controlled year-round environment in every learning space.
Mr. Quibble's quandary is a challenge to your designing skill.
Nesbitt—with a long experience in the school field—offers a
slide film presentation, case studies, cost data, and many other services
to help you give Mr. Quibble the right answer.

MORE LEARNING PER SCHOOL DOLLAR

Nesbitt AIR CONDITIONING FOR SCHOOLS

BASIC INGREDIENT Excellence Nesbitt Heating Ventilating Air Conditioning

Year-Round Syncretizer and Storage Cabinets • Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.

"ENTERPRISE Burners perform to our fullest expectations —year after year"

Says Otto Walters, Head Custodian, Capuchino High School, San Bruno, Calif.

Users, Engineers, Contractors—all agree:

"Everyone Benefits When It's an Enterprise"

The man who's on the job with heating operations day after day has the facts. At the modern, two-level Capuchino High School facility—which includes fifty-one class rooms, heated pool, gym, theater, auditorium, cafeteria, shops and kitchen—this man is Head Custodian Otto Walters. His four Enterprise Burners have delivered smooth, trouble-free service for both class rooms and hot water needs 5 days a week for nearly eight years.

On-the-job performance such as this naturally scores big with everyone down the line—dealer, engineer, contractor and user. Check the facts—you'll learn that the men who specify and work with Enterprise have found the best burner buy!

Fit your specifications to the *right* burner model from the complete range of Enterprise Burner sizes shown here:

HORIZONTAL ROTARY OIL BURNERS, & COMBINATION OIL & GAS BURNERS

INPUT				OUTPUT		
Burner Size	Motor HP	Oil-GPH Max	Gas CF/HR	Steam LBS/HR	Steam BHP	Radiation-Sq. Ft. Steam
AA	½	4	600	464	13	1880
A	½	7	1050	812	23	3280
C	½	15	2250	1740	50	7050
E	½	20	3000	2320	67	9400
F	¾	30	4500	3480	100	14100
G	1	35	5250	4060	118	16400
H	1	50	7500	5800	168	23400
H	1½	60	9000	6960	201	28200
J	2	75	11250	8700	250	35250
K	3	100	15000	11600	336	46900
L	3	135	20250	15660	453	63400
M	5	200	30000	23200	672	94000

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EQUIPMENT DEVELOPMENTS

Continued

Rule Measures Size And Weight of Duct

Duct weight rule consists of four scales printed on plastic. Cursur is also plastic. Printed with red and black lines on white or yellow background. When cursur is moved to a point where hair line intersects total footage line, total lb and sq ft of duct are obtained to ASHRAE metal gage standards. Measures duct sizes up to 120 in. semi-perimeter, and lengths from 1 to 100 ft. Overall dimensions are 8 by 11 in. Send for bulletin. — *Carl Raymond & Co., 3930 N. Mission Rd., Los Angeles 31, Calif.*

Seal-less Canned Pump Handles 500 F Fluids

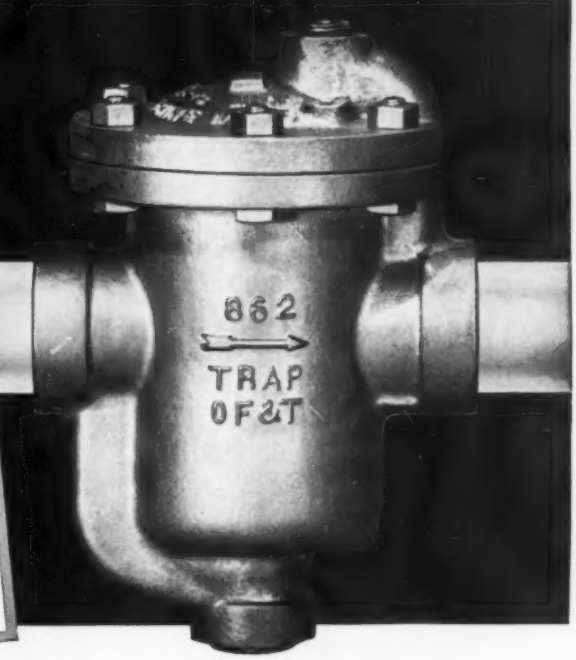
Delivers up to 100 gpm at heads up to 92 ft. Available in cast iron or 316 stainless steel. Handles temperatures up to 500 F. Only moving part is the rotor-impeller which is directly driven. Send for additional information.—*The Corley Co., Inc., 685 Myrtle Ave., Boonton, N.J.*

Heavy Duty Fastening Tool Uses Low-Velocity Principle

Drives 3/8, 5/16, and ¼ in. studs as well as heavy duty pins, into steel and concrete. Model "DX-500" uses a slow moving piston to supply the power. There is no trigger action. A blow with a 3 lb hammer is magnified by a slow burning blank charge. A pre-mounted washer guides driving action and assures that fastener will stop at predetermined depth. Literature sent on request. — *Hilti, Inc., Rapid Fastening Systems, 73 Southfield Ave., Stamford, Conn.*

Here are the steam traps designed especially for heating systems . . .

ARMSTRONG OPEN FLOAT AND THERMOSTATIC STEAM TRAPS



Engineered for low pressure intermittent service where large amounts of air accumulate while steam is off

Armstrong O.F.&T. Traps make it possible for heating systems to deliver the efficiency they were designed to deliver. They are ideal for low pressure unit heaters, preheat and reheat coils, converters, hot water generators, etc.

Advantages to the user:

BIG AIR HANDLING CAPACITY—Thermic vent handles large amounts of air in system when steam is turned on. Fixed vent handles normal air in system.

NO STEAM LOSS—Stainless steel valve is water sealed, is not damaged by dirt or scale, cannot develop steam leaks.

CONDENSATE AND AIR REMOVED AT STEAM TEMPERATURE—No opening lag.

LONG LIFE—All working parts, including open float, are stainless steel. Bodies and caps designed for 250 psig operation. Open float cannot collapse.

MINIMUM MAINTENANCE—Simple, proved design and high quality materials assure trouble-free service.

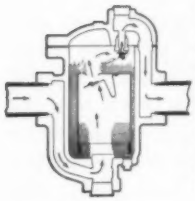
LOW COST—Mass production methods permit high quality at low cost.

EASY INSTALLATION—Horizontal straight-through pipe connections, conventional sizes.

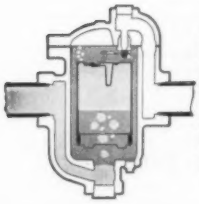
UNCONDITIONALLY GUARANTEED—All Armstrong Traps are guaranteed to satisfy the user or purchase price will be refunded.

920-STCOR

HOW ARMSTRONG O. F. & T. TRAPS WORK:



When steam is turned on, it pushes air through the wide open thermic vent and trap discharge valve at full differential pressure between supply and return lines. Condensate formed by incoming steam goes right through.



As steam reaches open float, thermostatic vent closes. Float fills with steam and rises to close trap valve. Residual air and CO_2 escape through fixed vent at steam temperature.

BULLETIN NO. 775 BULLETIN NO. 801

Use the coupon at right to get these helpful bulletins: No. 775 describes O.F.&T. traps fully. No. 801 tells how to select traps for draining unit heaters including data on 30 makes of unit heaters.

ARMSTRONG MACHINE WORKS
8742 Maple St. • Three Rivers, Mich.

Armstrong Machine Works
8742 Maple St., Three Rivers, Mich.

Please send me: ☐ O.F.&T. Trap Bulletin No. 775; ☐ Unit Heater Bulletin No. 801.

Name.....

Company.....

Address.....

City.....Zone.....State.....

Here's *WHY* KENNEDY VALVES

give you *more* valve for your money...

Fig. 425
125 lb. S.W.P. BRONZE GATE VALVE...

- **Rising stem**
  Inside screw
  Wedge Disc

Cylindrical body

This construction withstands sudden pressure, resists rupture and minimizes deflection under severe conditions. Wider hex ends, blended into body, prevent distortion during heavy wrench pressure. In this Kennedy design, body and hexes blend into one unit, no thin body wrists extending to pipe ends.

Fig. 425 conforms to Federal Specification WW-V-54, Type II, Class A. These valves can be repacked under pressure, thus eliminating line shut-downs. Simply open valve fully, remove packing nut and repack.

Available in sizes ⅜" through 3".

Find out how these valves can give you better, longer service. Get the complete story in Bulletin 613.

Write today.

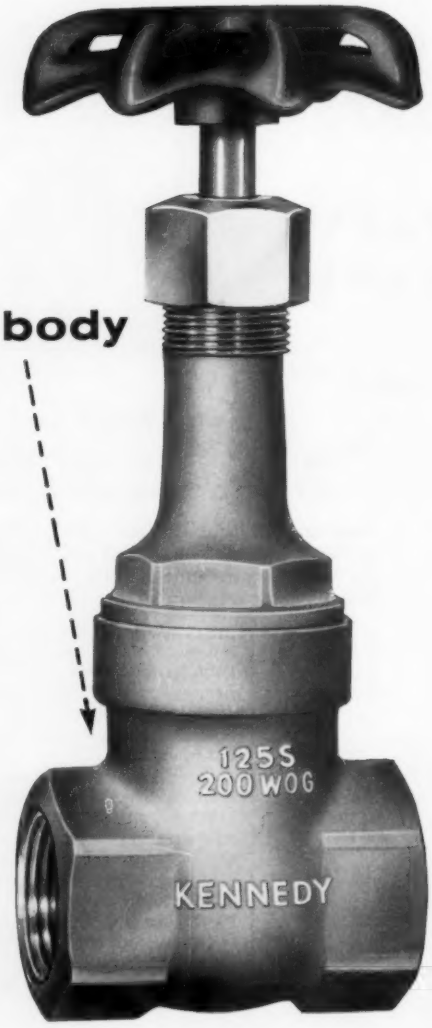


Fig. 425

These additional KENNEDY features help give long, trouble-free service:
KENALLOY® Stem
Pistol-Grip Handwheel

KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS
• OFFICES AND WAREHOUSES IN NEW YORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •
DUCTILE IRON VALVES • CAST IRON VALVES • BRONZE VALVES • INDICATOR POSTS • FIRE HYDRANTS

EQUIPMENT DEVELOPMENTS
Continued

Shaded Pole Motors Have Forced-Oil Lubrication Systems

All-angle 4 and 5 in. diameter shaded pole motors use a forced oil lubrication system that constantly recirculates, refilters, and recools the oil to increase bearing life. One-piece cast shell and bearing housing dampens vibration and minimizes magnetic and frequency pulsations. Each frame size (11 and 21) can be supplied for resilient-ring or end mounting. Each mounting style is available in open, totally enclosed non-ventilated, open with large internal fan, or totally enclosed fan cooled construction. Rated from 0.0115 to 0.1 hp, 60 cycle, 115 to 230 v. —*General Electric Co., Schenectady 5, N.Y.*

Portable Power Unit Cleans Boiler Tubes

Automatic cleaning of soot and scale from fire tube boilers is accomplished by an electrically operated punching brush that feeds into any boiler tube. One machine can service any number of boilers. Send for bulletin. — *Power Tube, Inc., 2325 N. W. Westover Rd., Portland, Ore.*

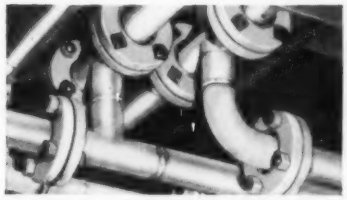
Flexible Epoxy Bonds Metal to Metal

Two-part thermosetting epoxy resin bonds metal to metal. Curing schedule varies, but usually the assembly can be moved in 1½ to 2 hr. Complete cure will occur in 24 to 48 hr at room temperature. The addition of heat (from 175 to 250F) greatly shortens curing time. Working life of mixure ranges up to 1½ hr, depending on mass of material mixed. Temperature range is from −40 to 250 F. — *Miracle Adhesives Corp., Bellmore, L.I., N.Y.*

OUTDATED SPECIFICATIONS INCREASE YOUR COSTS

PROCESS PIPING BIDS CAN BE REDUCED

IMPROVED FITTINGS DESIGN AND NEW PIPING STANDARDS CUT COSTS



The ultimate installed cost of corrosion-resistant process lines *can* be substantially reduced . . . where pipe line design specifications take full advantage of up-to-date developments in improved fittings design and new piping standards.

The most recent issue of the Code for Pressure Piping, ASA B31.3-1959, allows use of *light wall* Stainless Steel Schedules 5 and 10 pipe and fittings for critical process lines to a degree not possible with *outdated* specifications. The broader scope of pressure-temperature operating conditions included in this new code, permits computations utilizing these more economical wall thicknesses. This, plus a specification recognizing the efficiency of Speedline fittings, guarantees a soundly designed system at a *lower* installed cost.

Every Speedline fitting has built-in advantages that contribute to lower installation cost because they are designed especially for use with light wall Schedules 5 and 10 pipe. Speedline's extra length feature means butt joints are easier to align and easier to weld because you're always connecting "straight to straight". There's ample clearance to attach flanges to any or all ends of a Speedline fitting without fouling—by expanding or welding. Speedline aligning connectors assure sound socket-joining for both pipe and fittings. With Speedline—*one fitting* does it all. Review your process piping specifications to be sure they call for all of the cost savings possible with light wall pipe and modern Speedline fittings.

Speedline®

CORROSION-RESISTANT FITTINGS

STAINLESS STEEL • ALUMINUM • SPECIAL ALLOYS

100C

A PRODUCT OF **HORACE T. POTTS COMPANY** • 576 E. ERIE AVENUE, PHILADELPHIA 34, PA.

the weil TVC LOW RETURN CONDENSATE PUMP

10 **GALLON RECEIVER**
For single units. Diameter 21". Height of return above floor 6⅞".

15 **GALLON RECEIVER**
For single or duplex units. Diameter 25½". Height of return above floor 7⅜".

26 **GALLON RECEIVER**
For single or duplex units. Diameter 25½". Height of return above floor 10½".

- LOW RETURN CONNECTION
- LOW SPEED, 1750 R.P.M.
- CAST IRON RECEIVER
- LOW WATER LINE
- Capacities to 15,000 sq. ft. EDR, pressures 10 to 40 lbs.

SELECTION TABLE

UNIT NO.	SQ. FT. E.D.R.	CAP. G.P.M.	H. P.	PUMP DISCH.	HEIGHT OF RETURN	RETURN INLET
TVC 19	750	1.5	¼	1"	6⅞"	2"
TVC 23	1000	1.5	¼	1"	6⅞"	2"
TVC 29	2000	3.0	¼	1"	6⅞"	2"
TVC 35	4000	6.0	¼	1"	6⅞"	2"
TVC 41	6000	9.0	½	1"	6⅞"	2"

DISCHARGE PRESSURE: 20 LBS. DIAMETER OF RECEIVER 21"; CAPACITY 10 GAL. FOR COMPLETE SELECTION TABLE SEE BULLETIN TVC-300.

This compact receiver and sturdy pumping unit with its low return connection and 1750 RPM motor is economical to install and guarantees a long, trouble-free life. Single units in 15 or 26 gallon receivers can be converted to duplex units at any time when load increases. Additional pump is installed on the job.

SEND FOR BULLETIN TVC-300.
STOCKED BY YOUR JOBBER

weil PUMP COMPANY
1514 N. FREMONT ST.
CHICAGO 22, ILLINOIS

EQUIPMENT DEVELOPMENTS

Continued

Forced Air Space Heaters for Frequent Air Change Applications

Gas-fired "Directflow" heater is particularly suited to industrial plants where noxious gases, acid fumes, dust, or hot vapors are released and expelled by exhaust fans. Unit has no combustion chamber; combustion occurs in the air stream. Available in seven models, ranging in air output capacity from 11,000 to 60,000 cfm, and in heat output up to 6,750,000 Btu per hr with a maximum turndown ratio of 25 to 1. Can be equipped for either indoor or outdoor installation. Send for bulletin No. 580-14. — *Dravo Corp., Neville Island, Pittsburgh 25, Pa.*

Chain Assembly For Lifting Pipe

Minimizes the number of lifts required to lift and transport pipe and tubing. Consists of an "Accoloy 125" double leg sling chain with master link and pear-shaped end links to which are attached two triangular members. Several dropper chains are suspended from the triangular members, and can be equipped with any type of hook. — *American Chain & Cable Co., Inc., American Chain Div., York, Pa.*

Self-Curing Rubber Compound Has Multi-Function Application

Nonshrinking liquid or putty type rubber compound makes repairs to rubber products; dampens vibration; coats tanks, pumps, and other machinery. Does these tasks without heat, pressure, or expensive molds. Working life is 1 hr. Send for preliminary bulletin No. 50. — *Devcon Corp., Danvers, Mass.*

Keflex Manufacturing Division
U. S. Flexible Metallic Tubing Co.
Since 1905

LAMINATED STAINLESS STEEL BELLOWS

See Our Catalog in Sweet's Files

General Offices — 63 Main St., San Francisco 5, Calif.
Factories — Los Angeles — San Francisco
Sales Offices — Agents in Principal Cities of U. S. and Canada

KEFLEX QUADRA-SIDE EXPANSION COMPENSATORS

FOR STEAM AND HOT WATER HEATING SYSTEMS
USED WITH CONVECTOR AND FIN TUBE BASEBOARD RADIATION UNITS
IN SCHOOLS, HOSPITALS, OFFICES AND COMMERCIAL INSTALLATIONS

TYPE 7 Q square brass telescoping case protects laminated stainless steel bellows from torsion, squirm, misalignment and external damage. Compensators are used in high and low pressure hot water supply lines, risers and for baseboard radiation. Extra flexibility provides maximum cyclic life. Units are very compact and rugged. Sizes ¾" thru 3". Pressures to 300 PSI. Temperatures to 800°F. Traverse: Single Units, total 2" (1-½" compression, ½" extension) Dual units available.

TYPE 11 Q-T has heavy square telescoping case and laminated stainless steel bellows. For use in risers and with baseboard radiation. Test pressure 150 PSI, working pressure 100 PSI, temperatures to 300°F. Traverse: Total 1" (¾" compression, ¼" extension).

TYPE 7 Q WITH BRASS FEMALE THREADED ENDS

Working Pres. 300 PSI Maximum
Temp. 800 F

Pat. No. 2,931,669.

Nom. I.P.S.	Overall Length	Max. O.D.	Wt. #
¼"-1.00"-1.25"	6.50"	2.00"	2
1.50	6.50	2.50	4
2.00	6.50	3.00	5
2.50	6.50	3.50	6
3.00	6.50	4.00	9

TYPE 7 Q-T WITH COPPER TUBE ENDS

Maximum Pres. 200 PSI Maximum
Temp. 300 F

Pat. No. 2,931,669.

To Fit Copper Tubing		Overall Length	Max. O.D.	Wt. #
Nominal I.D.	Actual O.D.			
¾"	⅞"	6.50"	2.00"	1½
1	1⅛	6.50	2.00	1½
1¼	1⅜	6.50	2.00	1½
1½	1⅝	9.00	2.50	3½
2	2⅛	10.00	3.00	4½
2½	2⅝	10.75	3.50	5½
3	3⅛	11.50	4.00	8¼

TYPE 11 Q-T WITH COPPER TUBE ENDS

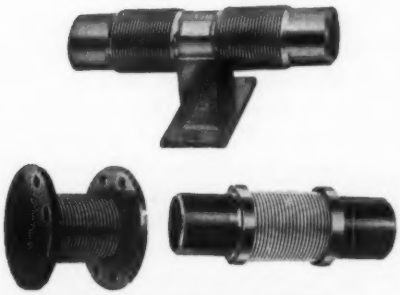
Maximum Pres. 100 PSI Maximum
Temp. 300 F

Pat. No. 2,931,669.

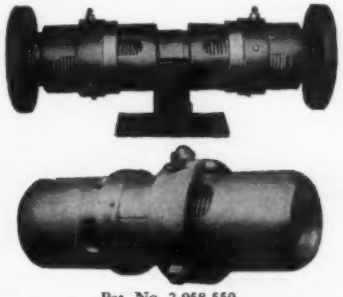
To Fit Copper Tubing		Overall Length	Max. O.D.	#
Normal I.D.	Actual O.D.			
¾"	⅞"	4.50"	1.50"	1¼
1	1⅛	4.50	1.50	1¼
1¼	1⅜	4.50	1.75	1½
1½	1⅝	4.50	2.25	3
2	2⅛	4.50	2.75	4

EXPANSION JOINTS—VIBRATION ABSORBERS—FLEXIBLE CONNECTORS—PIPE GUIDES

Force Required to Compress Keflex Expansion Joints Their Full Rated Traverse is Usually Less Than 100 Lbs., Total

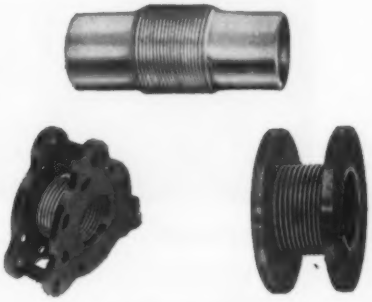


KEFLEX EXPANSION JOINTS — corrugated, packless type for steam and hot water heating systems and process piping. Laminated stainless steel bellows with internal liner guides and stainless steel contour control rings. Weld ends, or flanges. Outside shrouds and intermediate anchor bases available. Sizes 2" through 48". Pressures 70 to 450 PSI. Temperatures to 800° F. Furnished for various required traverses.



Pat. No. 2,958,550

KEFLEX-KETROL CONTROLLED EXPANSION JOINTS — positive protection against torsion. For use in pipe lines to compensate for expansion and contraction. Shroud has intermeshing fingers providing concentric guiding and protection against squirm, torsion, and external damage to laminated stainless steel bellows. Designed for high pressure, high temperature hot water service. Movement is controlled by limit stops. Sizes 2" through 48". Pressures to 450 PSI and temperatures to 800° F.



KEFLEX FLEXIBLE CONNECTORS AND VIBRATION ABSORBERS — to absorb vibration from pumps, chillers, and compressors. Serves to relieve stress on pump volute when piping is misaligned. Extra flexibility of laminated stainless steel construction produces long cyclic life. Compact units save space and are easy to install. Available with or without tie rods. Sizes 2" through 48". Pressures to 450 PSI and temperatures to 800° F.

Modified Types are available for special conditions requiring hig her pressure, temperatures, traverse, or combination deflections.

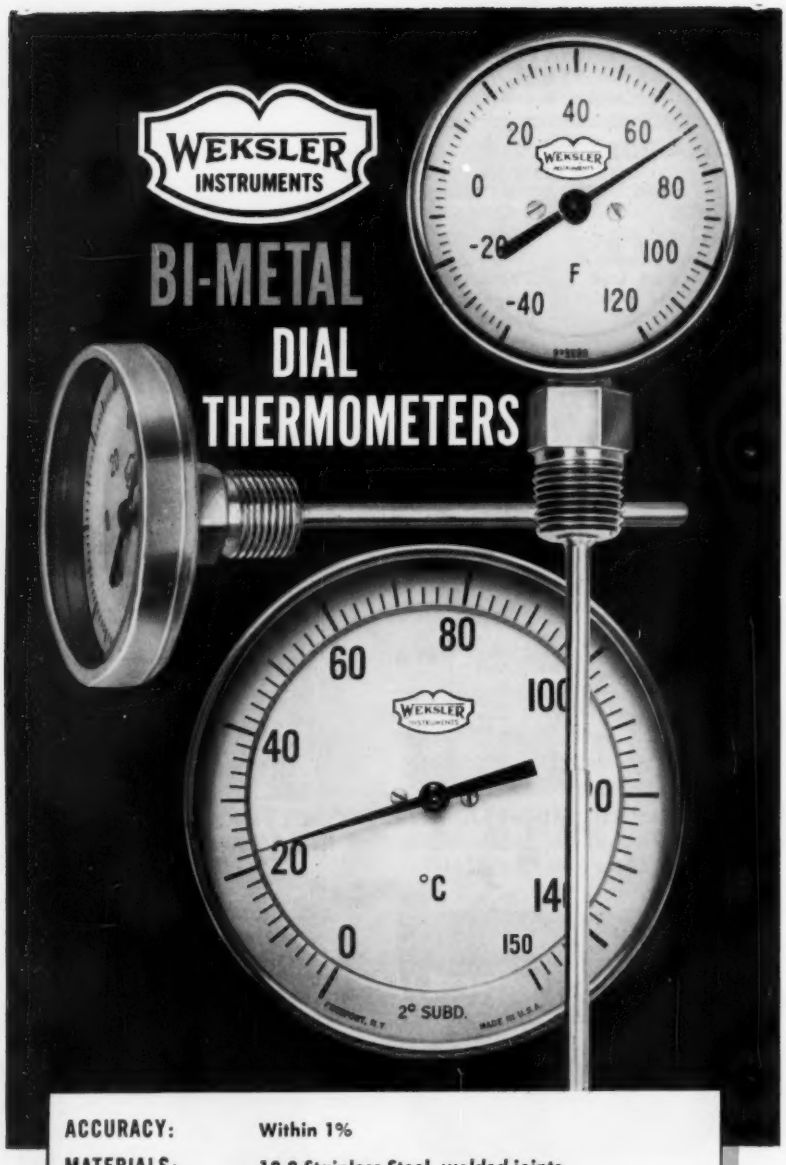
KEFLEX-MAVE TYPE M

Fabricated steel pipe guides for concentric guiding of pipe lines. Special insulated guides are available for chilled water.

FLEXIBLE "BMH" CONNECTORS

"USF" BRONZE VIBRATION ABSORBERS

Braided bronze Metal Hose assemblies made in standard lengths. Usually used as flexible connectors on pumps and other mechanical equipment for heating and air conditioning service. Available with threaded male ends, flanges, and copper tube sweat ends.



ACCURACY:	Within 1%
MATERIALS:	18-8 Stainless Steel, *welded* joints
WORKMANSHIP:	The finest, right through to *individual calibration*
COST:	Being Weksler, cost is *always* moderate

Weksler Bi-Metal Dial Thermometers are incomparable for every type of scientific temperature measurement. Dished anti-parallax dials, stem lengths to fit *all* standard thermo-wells, gasket sealed bezels, heavy crystal, *external* adjustment, and *all* standard F and C ranges are features you expect and *get* from Weksler!

WRITE FOR BULLETIN 700

WEKSLER INSTRUMENTS

"ORIGINATORS of WORLD RENOWNED ADJUST-ANGLE THERMOMETERS"

WEKSLER INSTRUMENTS

CORPORATION

195 EAST MERRICK ROAD, FREEPORT, L. I., N. Y.

Indicating and Recording Instruments for Temperature, Pressure and Humidity

EQUIPMENT DEVELOPMENTS

Continued

Curved Blade Register For Ceiling or Sidewall Installation

Registers and grilles have curved aluminum blades that extend beyond the grille face and adjust individually to each installation. Four different face designs are available, providing one, two, three, or four way air pattern control. Horizontal multilouver valves in the rear control air volume. System can be balanced at the face of the register by setting the adjustable stop on the operator handle to limit valve opening. Sizes range from 8 by 6 in. to 14 by 14 in. Send for bulletin No. 305-AC. — *Air Control Products, Inc., Coopersville, Mich.*

Pipe Threader for Field Application

Electric operated unit threads pipe in sizes from ⅛ to 2 in. Constructed of aluminum; weighs 18½ lb; and has ball bearings on all moving parts. Will cut a 2 in. thread in less than a minute and remove itself from the pipe immediately with its reversible motor. Operates on 110 v. — *Amaz-O-Thread Sales Co., P.O. Box* 39752, *Los Angeles* 39, *Calif.*

Hand Embossing Tool Makes Labels for Coding

Makes raised-letter labels for coding pipe, valves, and other applications. Will make labels that read up and down as well as across. Tool uses vinyl tapes that are available in different colors making color coding possible. Tapes have self-sticking backs. — *Dymo Industries, Inc.*, 2950 *Seventh St., Berkeley* 10, *Calif.*

NEW ANEMOSTAT PLANT

Combines finest, most efficient production and research facilities in the air conditioning industry.

- Manufacturing Area = 165,000 sq. ft. in modern, one story building.
- Research and Development Area = 10,000 sq. ft. with complete facilities for radiated sound power measurement of air flow and temperature equalization.
- Three Test Chambers = two, specially constructed to provide reverberant room for sound measurement through all frequency bands in conformance with the recommendations of the ASHRAE Standards Project Committee.
- Monitor Master Panel Board = for recording and controlling all conditions throughout each chamber.
- Climatic Test Window = for demonstrating and testing all heating and cooling problems.
- Hydraulic-Electric Moveable Floor = for varying floor to ceiling heights.

These new facilities will help us to serve you better — deliver faster and have room to expand to meet the growing needs of the air conditioning industry. From our Research and Development program will come the units that will be the standard of excellence in tomorrow's buildings.

You are cordially invited to examine these outstanding facilities.

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WHY IS

AUBURN

THE

QUALITY TRENCHER?

Where it's manufactured?

Auburn Machine Works, Inc., established 1928, long known as the "House of Trenchers" is justly proud of its modern, precision equipped manufacturing facilities. Equipment that assures "Quality Controlled" production.

You get more trench for your money—day in and day out—and at less cost with an AUBURN. Simple and rugged in design, it's virtually trouble-free. Its variable hydraulic drive automatically adjusts the speed to changing soil conditions. One man operates it digging up to 800′ per hour, 6″ to 14″ wide and down to 6′ deep.

Job proven . . . AUBURN is the first choice of contractors, utility and telephone companies throughout the world. It is the most profitable trencher you'll ever own, ask any AUBURN owner . . . he'll recommend it.

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MACHINE WORKS, INC.
2145 South J Street
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Phone BRidge 4-3141

Please send complete information and name of nearest dealer.

*Name*_____

*Address*_____

*City*_____ *State*____

EQUIPMENT DEVELOPMENTS

Continued

Heat Exchanger Has Copper Tube in Steel Tube Design

"Lime-Lite" heat exchanger has a 1¼ in. OD copper boiler tube running full length inside a 2 in. OD primary steel tube from header to header. Hot water or steam is generated in the primary boiler and the heat is transferred to the media being circulated through the heat exchanger. Full boiler capacity may be obtained with a 60 F temperature differential between the primary and secondary outputs. Unit may be divided into two or three pass sections. Special tube materials are available. — *Rite Engineering and Mfg. Corp.*, 9441 *Washburn Crossing Rd., Downey, Calif.*

Charging and Purging Valve Rated for 400 Psi, 300 F

Valve enables charging and purging of refrigerant lines, or other lines containing fluids, non-corrosive to brass or steel. Can be installed in the branch of a horizontal "T" or in the end of a vertical "T" located in a high point in the system. Valve inlet is machined inside and out, permitting OD sweat or OD male (for internal mounting) connections. Side opening has flared connection. Rated for 400 psi maximum working pressure and 300 F maximum temperature. Bottom connection ⅜ through ⅝ in. ODM and ¼ through ½ in. ODS. Side connections are ¼ and ⅜ in. flare. Catalog sent on request. — *Henry Valve Co.*, 3215 *North Ave., Melrose Park, Ill.*

Combustion Gas Alarm Uses Diffusion Sampling

Diffusion-head type alarm for continuous monitoring of natural gas, LP, and other combustible gases and vapors. Analyzer unit is housed in a dust-proof aluminum case for flush or surface mounting and should be located in a gas-free area. Indicating meter, lamps, and operating controls are displayed through the glass window in the hinged door. Transistor-regulated power supply holds constant voltage to the filament despite power line variation. The head containing the detector filament is enclosed in a cast iron housing for location in the monitored area. — *Johnson-Williams, Inc., Palo Alto, Calif.*

Transparent PVC Tubing Resists Corrosion

"Clearflo" transparent polyvinyl chloride tubing combats corrosion in the transmission of gases, acids, alkalies, petroleum products, sea water, and other chemicals and materials. Non-porous product has almost mirror-like interior and exterior surfaces which resist staining, bacterial growth, and dirt accumulation. Available in two reinforced versions for use with high pressures and to resist crushing. One version is reinforced with a steel wire spring; the other features a nylon braiding having burst pressures up to 1000 psi. Send for free samples and information. — *Newage Industries, Inc.*, 222 *York Rd., Jenkintown* 46, *Pa.*

Double Pipe Heat Exchanger For High Pressure Applications

Incorporates a bundle of fintubes into a high pressure, hairpin type shell. Suited for high pressure operations up to 6000 psig in the tubes, and 1800 psig in the shells. A metal sealing ring between the tube and shell results in a tight closure. Shell inlet and outlet nozzles are Van Stone or lap joint type flanges that can have either RTJ, M & F, or R. F. stub ends. Available in 4 in. shell size. Also available with bare tubes. Send for bulletin No. 112. — *Brown Fintube Co.*, 300 *Huron St., Elyria, Ohio.*

A Real TIME SAVER

SONOCO

SONOAIRDUCT.

FIBRE DUCT

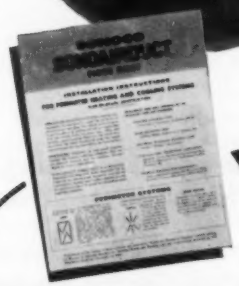
Faster Installation from start to finish — that's SONOAIRDUCT. Designed for use in all types of slab perimeter heating, cooling, or combination systems, SONOAIRDUCT saves time, labor and money for contractors and owners.

Heating men *like* using SONOAIRDUCT Fibre Duct. It's lightweight for easy handling and leveling. Long lengths mean fewer joints. And, it can be cut to size or mitered with a hand saw.

This "on-the-job adaptability" means more jobs completed *on time*—at less cost!

SONOAIRDUCT is dependable too—meets or exceeds all F.H.A. criteria and test requirements for this type product. No worries either—because with SONOAIRDUCT, there are no sharp edges, no breakage. On your next slab perimeter job, specify . . . buy . . . install SONOAIRDUCT — the original Fibre Duct.

Available in 23 sizes, 2″ to 36″ I.D., standard 18′ lengths.



FREE INSTALLATION MANUAL

Contains latest, detailed, step-by-step installation data for SONOAIRDUCT Fibre Duct. For free copy, send us your name and address on company letterhead.

See our catalog in Sweet's

For complete information and prices, write

SONOCO

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Construction Products

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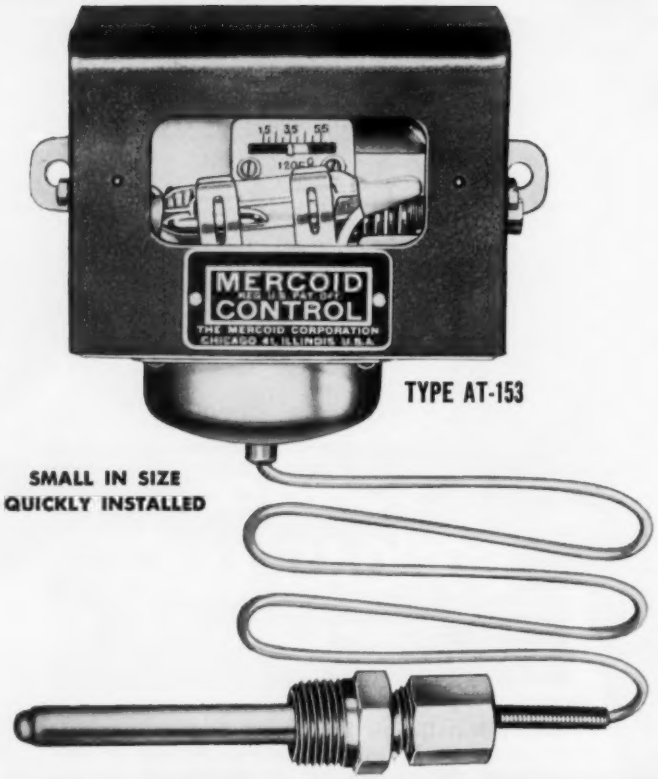
NEW
TEMPERATURE CONTROL



TYPE AT-153

SMALL IN SIZE
QUICKLY INSTALLED

FOR REFRIGERATION—AIR CONDITIONING—FREEZE PROTECTION AND VARIOUS INDUSTRIAL APPLICATIONS

CIRCUIT

SP-DT HERMETICALLY SEALED MERCURY SWITCH (4A. 115V., 2A. 230V.)

Provides any of the following operations:
Single Pole—cut in high (close on rise)
Single Pole—cut in low (open on rise)
Single Pole—Double Throw

OPERATING RANGE

Operating Range °F.	Min. Differential °F. (Fixed)
15 to 55°	2.5°

Exclusive Features

EXTERNAL ADJUSTMENT
VISIBLE CALIBRATED DIAL
VISIBLE SWITCH POSITION
SEALED MERCURY CONTACT

WRITE FOR
BULLETIN NO. 0-28

MERCOID CONTROL
THE MERCOID CORPORATION
4209 Belmont Ave., Chicago 41, Ill.

EQUIPMENT DEVELOPMENTS
Continued

Flame Inspection Mirror Has Telescoping Handle

Mirror heads are made of heavy chrome plate polished to a mirror finish, available in two sizes: a round mirror is 3⅞ in. diameter; a rectangular mirror is 3⅞ by 1 15/16 in. The telescoping handle extends 29 in. and is 10½ in. long when folded. A swivel bracket is mounted on a ball joint to allow viewing of fire from any angle. Send for additional information. — *Delavan Mfg. Co., West Des Moines, Ia.*

Air Conditioning Switch Has Single or Double Throw

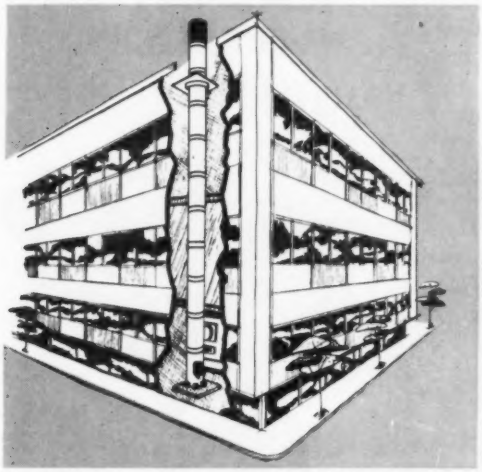
Maintained contact electric switch used for any application that requires a-c double throw, center "off" switch controls. A fiber insulating wrap-around is assembled under the switch cover and can be folded down over the terminals to protect the wiring when switch is installed in small enclosures. Send for additional information. — *Pass & Seymour, Inc., Solvay Station, Syracuse 9, N.Y.*

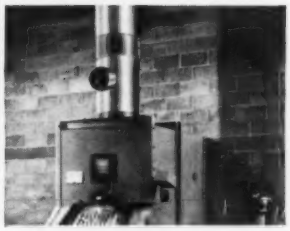
Adhesive Bonds Glass, Plastic, Steel, and Wood

Can be spray applied in a relatively dry form and requires only contact pressure for bonding polystyrene, sheet plastic, steel, aluminum, wood, particle board, and foamed glass. Suitable for temperatures from −30 to 250 F. — *Minnesota Mining and Mfg. Co., Adhesives, Coatings and Sealers Div., 900 Bush Ave., St. Paul 6, Minn.*

FLINTKOTE® VAN-PACKER® Refractory Industrial Stacks

Solving Industrial Stack Problems





Van-Packer stack is easily installed inside most buildings. Its use permits greater freedom of location for the boiler or incinerator. The Van-Packer Model HT stack is the only commercial or industrial stack listed by Underwriters' Laboratories, Inc.

Underwriters' Laboratories, Inc.®
INSPECTED
Van-Packer Model HT Smokestack

Van-Packer industrial stack is easily located inside tall buildings

More and more architects and designers are specifying Van-Packer industrial stacks to simplify design requirements of their buildings and at the same time permit greater floor plan flexibility and more pleasing architectural effects.

Factory-built of 3-foot insulating refractory sections, the Van-Packer Model HT stacks can be located anywhere inside (or outside) the building to handle virtually any commercial or industrial incinerators as well as boilers or furnaces. You need allow only a 4-inch clearance to non-combustible construction to meet Underwriters' Laboratories specifications. Where the stack passes through combustible floors, a special insulating refractory thimble fits around the stack section and requires no additional clearance. This thimble is also used together with the Van-Packer flashing and counter flashing where the stack passes through combustibles at the roof.

Van-Packer stack sections are encased in an aluminized steel jacket which needs no routine painting or maintenance. Thus, your design can be made with minimum provision for stack accessibility.

The Van-Packer stack can be installed on concrete or brick pier foundations, floor supported, supported by wall brackets, or super-imposed directly on the incinerator or boiler. Where breechings are required, merely specify a Van-Packer straight section for that purpose. It is easily connected to the tee section opening, which has inner diameter equal to that of the stack.

Van-Packer stacks are available in sizes to meet virtually all application requirements, with these inner diameters: 10, 12, 15, 18, 21, 24, 30, and 36 inches. Cost of a Van-Packer is about the same as a steel stack for a comparable application, yet the non-corroding refractory construction results in an average life three times longer. Draft provided is equal to that of equivalent brick stacks (greater that that of equivalent steel stacks), assuring more efficient operation of the equipment served.

Van-Packer Model BF stack for boilers and furnaces

In addition to the UL-listed Model HT stack which handles incinerators with flue gas temperatures up to 1800°F (up to 2000°F for occasional brief periods of forced firing), Van-Packer also offers the Model BF stack (not UL listed). This low cost refractory stack is ideal for boilers and furnaces with flue temperatures to 800°F. It is identical to the Model HT stack except for the refractory formula used in casting the stack sections, and is available in the same inner diameters.

For complete information on Van-Packer industrial stack, write for Bulletin IS-49.

For residential use, specify Van-Packer all-fuel chimney

Here's a low-cost, factory-built tile-lined residential chimney that's safe and attractive. Specify either metal or asbestos-cement housing with embossed brick design. Choice of four non-fade brick colors: red, white, buff, and gray. Factory-built 2-foot flue sections have 5/8-inch fire clay tile liner, 3-inch vermiculite-concrete insulating wall, and asbestos-cement outer jacket. Van-Packer chimney is UL-listed for all fuels, is safe for incinerators. Write for Bulletin RS-1.

FLINTKOTE® VAN-PACKER®

The Flintkote Company

Manufacturers of Diversified Products for Home and Industry

30 Rockefeller Plaza, New York 20, N. Y. Phone: PLaza 7-5500

In the West: Pioneer Division, The Flintkote Company, P. O. Box 2218, Terminal Annex, Los Angeles, Calif.

In Toronto, Ontario: The Flintkote Company of Canada, Ltd.

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide
Changes that Danger Zone to a
SAFETY ZONE

—*enables you to*
ADD PLANT AREA

If re-aligning equipment will yield more working space, better production, lower costs—do it now. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman or contact us direct.

Babbitt 168-9
STEAM SPECIALTY CO.
8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

EQUIPMENT DEVELOPMENTS
Continued

Inline Filter Has Removable Element

Permits removal and replacement of the filter element without removing the filter housing from the system. Elements are 316 sintered stainless steel, available in various micron sizes. Filters are available in brass and type 316 stainless steel with "Buna N" or "Vitron A" O-rings and rubber gaskets, and "Swagelok" tube fitting connections. — *Nuclear Products Co.*, 15635 *Saranac Rd., Cleveland* 10, *Ohio.*

Ceiling Diffuser Dampers Available in Galvanized Steel

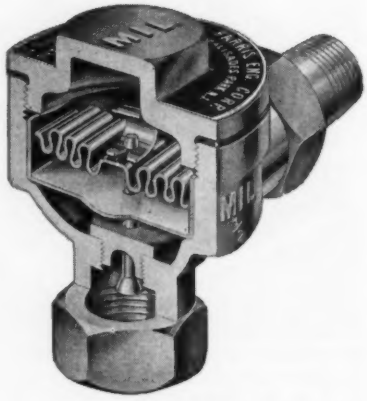
Dampers are operated by a screw-type nylon rack and pinion mechanism. Back-lash tolerances in the mechanism are close to zero in order to prevent blade flutter under high air velocities. An adjustable stop enables balancing the system at the diffuser face. Send for bulletin No. 302-AC. — *Air Control Products, Inc., Coopersville, Mich.*

Tubing Cutter for 1/8 Through 7/8 In. Tube

Hand unit requires only a 2 in. clearance from the center of the tubing regardless of tubing size. Both the cutter jaw and the roller jaw move together so that the overall length of the tool does not change within its cutting range. —*Robinair Mfg. Corp.*, 1124 *S. East Ave., Montpelier, Ohio.*

Farris

TYPE 25 RADIATOR STEAM TRAPS



CUT REPLACEMENT

Farris Type 25 Mil Steam Traps outlast ordinary bellows and float traps 10 to 1. Many have been in constant daily service for 15 years without maintenance or repair. Features like these tell why:

- **Indestructible stainless steel bi-metallic thermal element**
- **Unaffected by corrosion, water hammer, fatigue, or rough handling**
- **Precision-forged bronze construction with stainless steel working parts**
- **STANDARDIZE . . . 1 size takes the place of 3**

BOOST PERFORMANCE

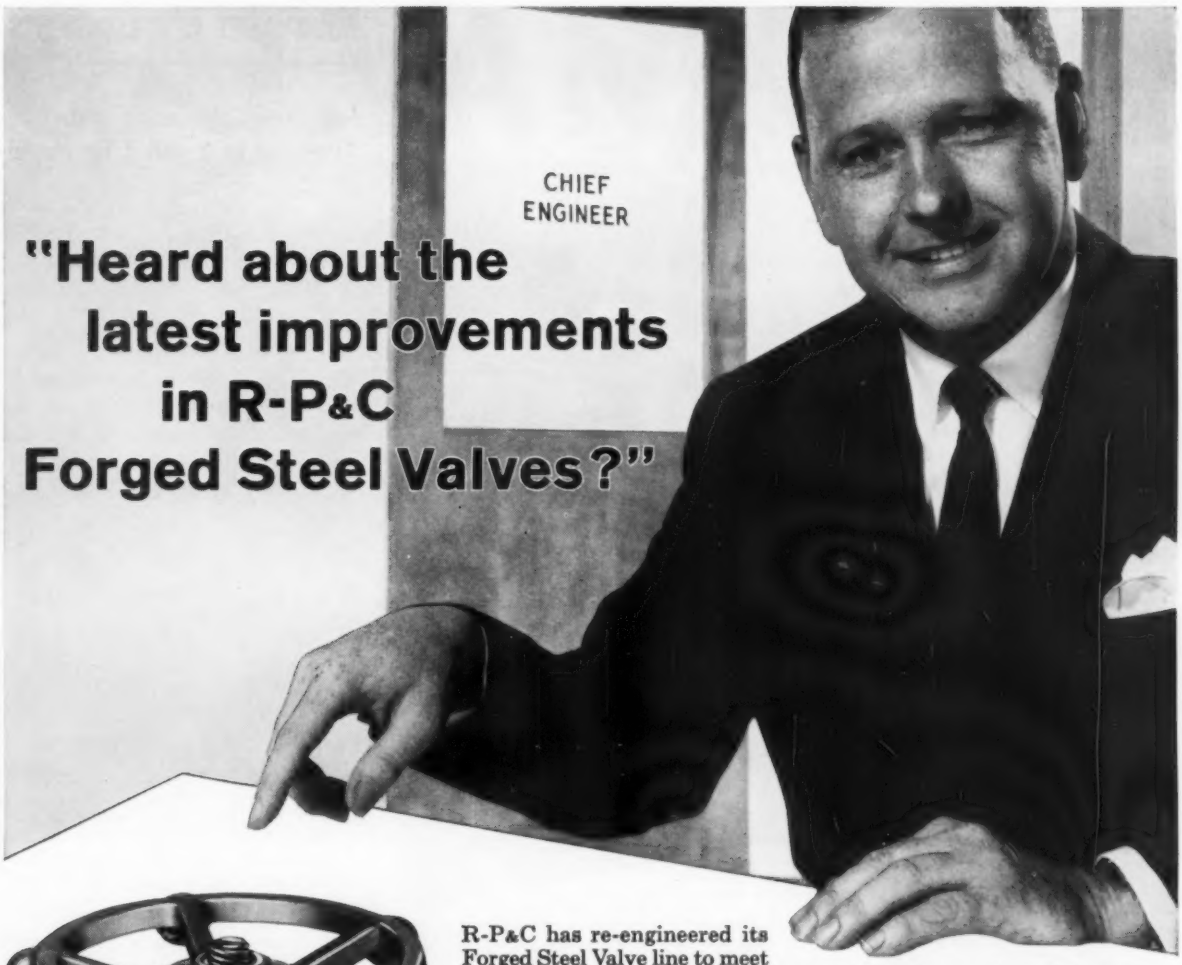
Maximum steam line performance and economy is assured by Mil Steam Traps' unique construction:

- **Rapid response to temperature change**
- **High pressure quality at low pressure cost**
- **Highest capacity for L.P. heating**
- **No steam loss—tight shut-off**

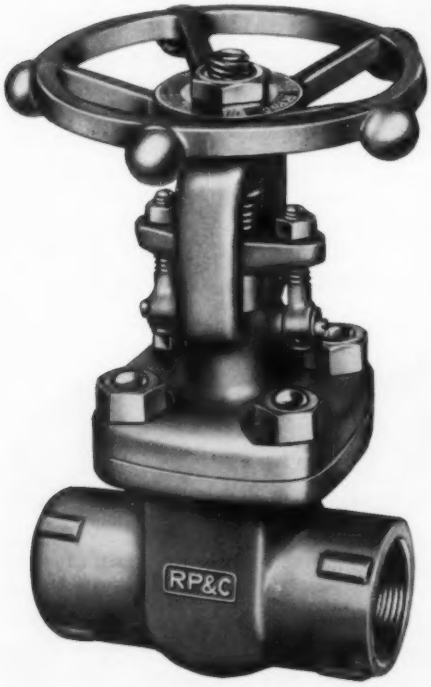
FARRIS MIL STREAM TRAPS ARE GUARANTEED TWO YEARS

FREE: Information on complete Farris Mil line for pressures from 0-25 psi, 0-65 psi, 0-125 psi, 0-225 psi to 0-300 psi, write for catalog FE-310

Farris ENGINEERING CORP.
MIL DIVISION
562 Commercial Avenue
Palisades Park, N. J.



"Heard about the latest improvements in R-P&C Forged Steel Valves?"



R-P&C has re-engineered its Forged Steel Valve line to meet the highest standards of quality for the Refinery, Chemical, Power and Process industries. These valves incorporate the most up-to-date design and material improvements found in any forged steel valve! One example is the stuffing box—redesigned for 50% greater sealing efficiency. These improvements add up to longer, trouble-free valve service for you, with minimum maintenance.

Here are other R-P&C Forged Steel Valve improvements:

- **Stellite-faced seats, lapped to 2-3 micro-inch finish; results in a durable seal**
- **Redesigned body bonnet joint gives 25% increase in gasket sealing area**
- **"390 Brinell" stem with rolled threads for continuously smooth movement**
- **Moly-Disulphide lubricated oil grooves in operating nut give easiest operation**
- **1200°F premium packing—uniformly compressed and graphited —includes a proved inhibitor that prevents corrosive damage**
- **Thrust washer between handwheel and operating nut eliminates seizing and galling**

In addition to Forged Steel Gate and/or Globe Valves, R-P&C distributors offer users in all industries a complete line of R-P&C gate, globe and angle valves in all standard materials: iron, bronze, bar stock, cast steel—plus many specialties.

See your R-P&C distributor for full details and prompt service.

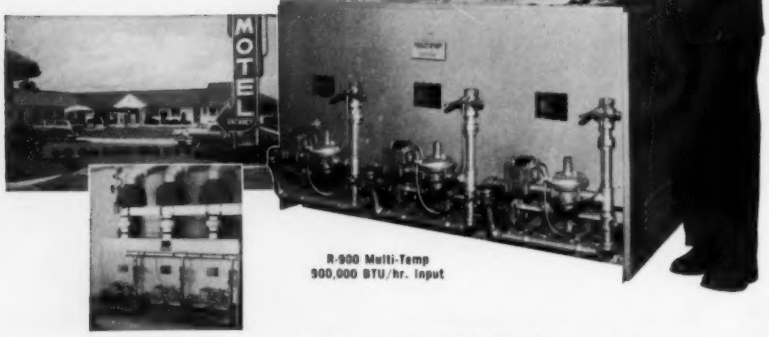
R-P&C VALVES

ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.

Reading, Pa., Atlanta, Boston, Chicago (Melrose Park), Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

when the heat's on



R-900 Multi-Temp
900,000 BTU/hr. Input

be sure it's

When the job's got to be right . . . at the right price . . . remember Hydrotherm!

Gas heat costs less than oil heat in big jobs (to 3,600,000 BTU/Hr) when you install Hydrotherm's MULTI TEMP hydronic system.

Sequence-fired combustion chambers permit automatic input modulation in accordance with load requirements — no short cycling — no override — built-in standby protection. Factory assembled . . . fits through a 2 ft. 6 in. door.

Easy to install, all cast iron, and guaranteed for 10 years . . . you can't miss with Hydrotherm.

Write for bulletin #HY-F107 and all the facts.

HYDROTHERM MULTI TEMP

HYDROTHERM, INC. DEPT. 13HP. NORTHVALE, NEW JERSEY

EQUIPMENT DEVELOPMENTS

Continued

Fan-Type Condensing Unit Available in 2 and 3 Hp Models

For use with firm's evaporators in air conditioning installations using upflow, downflow, or horizontal flow furnaces. Condensing unit can be located outside the building or on a roof. Cooling coil fits on top of furnace. Entire system is cleaned, dehydrated, and precharged with Refrigerant 22. Available in 2 and 3 hp models. — *Gaffers & Sattler,* 8111 *W. Beverly Blvd., Los Angeles* 48, *Calif.*

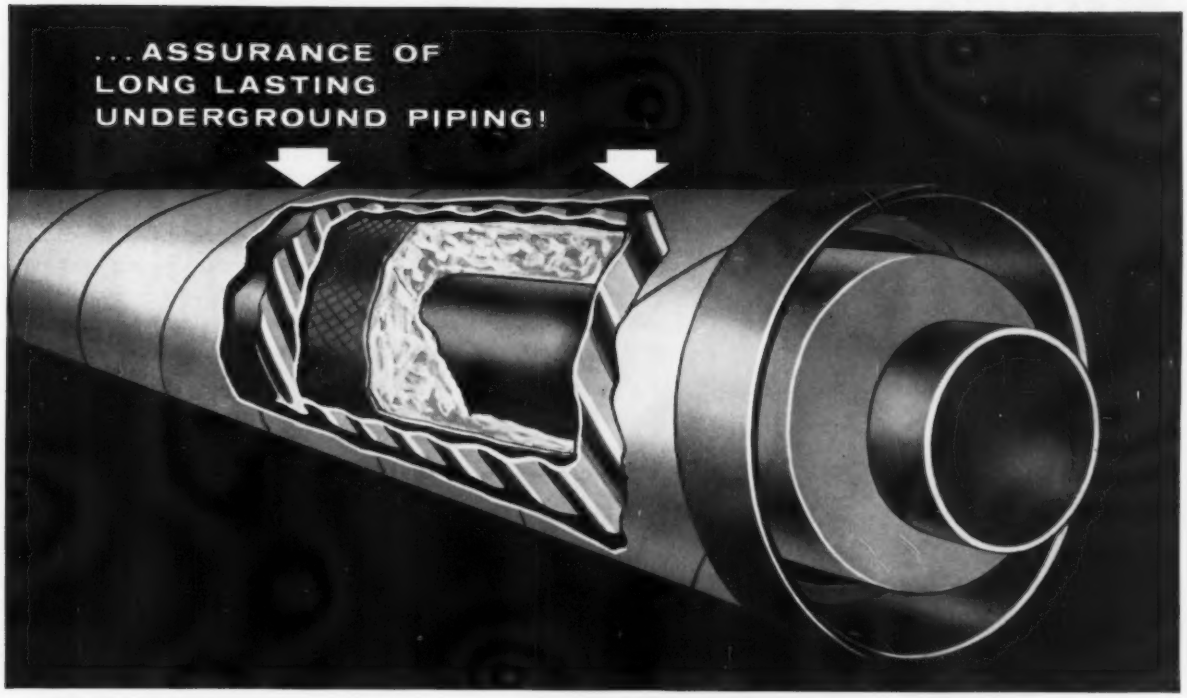
Bar Stock Valves For Tube and Pipe Connections

Screwed bonnet valves for ⅛ to ¼ in. in tube and pipe connections. Available in type 316 stainless steel and monel with a choice of "Swagelok" tube fitting connections, inlets and outlets, or female pipe thread connections on straight and angle pattern styles. Feature panel mounting; "Teflon" cylinder packing; and micro-regulating and non-regulating stems. Colored handles are available for coding. — *Whitey Research Tool Co.,* 5525 *Marshall St., Oakland* 8, *Calif.*

Stainless Steel Jacket Insulates Pipe

One-step insulating system for pipe consists of high temperature "Thermobestos" (calcium silicate) insulation with a stainless steel jacket. "Metal-On" is measured, cut, and applied in one operation. Can be easily removed for repair or inspection. — *Johns-Manville Corp.,* 22 *E. 40th St., New York* 16, *N. Y.*

GALVANIZING

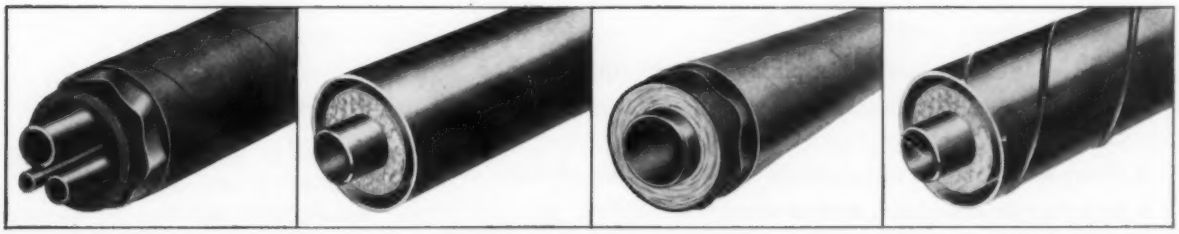


Hot-dip galvanizing of the Hel-cor Conduit in a Ric-wiL system offers the finest in corrosion protection. The Zinc actually alloys to the steel and becomes an integral part of the conduit . . . not just a surface coating. The Automobile Industry has announced through The American Zinc Institute that after testing 450 coatings, Zinc was best from the standpoint of resistance to corrosion.

The illustrated catalog offers a wealth of information on types' of systems, engineering, specifications, and installation methods . . . write today for your copy. . .

OTHER AVAILABLE

RIC-WIL SYSTEMS...



UNILINE **CAST IRON** **LO-TEMP** **IMPERIAL**

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

RIC·WIL PREFABRICATED INSULATED PIPING SYSTEMS

CENTRAL OFFICE: RIC-WIL INCORPORATED, BARBERTON, OHIO
WESTERN STATES: RIC-WIL INCORPORATED, WESTERN DIVISION, NEWARK, CALIFORNIA
IN CANADA: THE RIC-WIL COMPANY OF CANADA LTD.

Costs Less Because It Gives the Most in Service

When selecting unions it will pay you to remember 2 things: (1) Darts can be used over and over again — on location after location (2) On location after location, they give a drop-tight seal. How can you beat this combination for economy . . . at any price?

QUICK FACTS

- Extra wide bronze seats resist pitting and corrosion
- Nut and body of air-refined, high test malleable iron are practically unbreakable
- Heavy shoulders can withstand the toughest wrench abuse
- Each Dart is individually vacuum-tested

DART UNIONS *Products of* **DART UNION COMPANY** PROVIDENCE 5, R.I.

GENERAL SALES AGENT

THE **Fairbanks** COMPANY
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AVAILABLE THROUGH YOUR LOCAL DISTRIBUTOR

RECENT TRADE LITERATURE . . .

Centrifugal Liquid Chillers

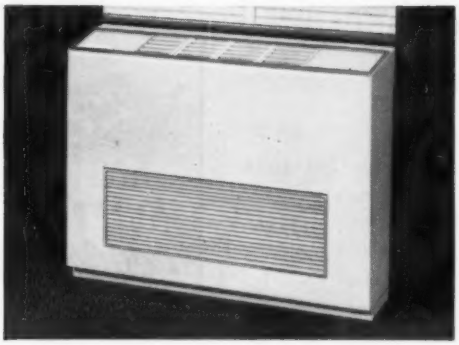
Four page bulletin 4326 describes "Packaged Tonrac" units with choice of energy source: electricity, steam, or gas. Package includes insulation on cooler shell, water boxes, and cool refrigerant piping. No auxiliary piping or control piping is required in the field. All regulatory components also included. Unit can be moved through a 36 in. door. Illustrated with photos, some with cutaway views. — *American-Standard Industrial Div., Detroit 32, Mich.*

Heat Transfer Design Manual

Twelve page design manual HDM-761 gives graphical solutions in Btu per sq ft per hr and watts per sq ft versus temperature difference to all types of heat transfer problems. Covers problems of conduction, free convection, and radiation; combination free convection and radiation; warm-up; and electrical aspects. Also contains data on heat transfer coefficients and specific heat and thermal conductivities. — *Electrofilm, Inc., 7116 Laurel Canyon Blvd., North Hollywood, Calif.*

Central Air Conditioning

Fifty-six page catalog 560 describes "Seasonmaster" central station air conditioners for low and medium pressure, single zone, double duct, and multi zone application. Information given on coils, blowers, and other design features. Includes dimensional data and specifications. Illustrated with photos, line drawings, and tables. —*McQuay, Inc., 1601 Broadway St. N.E., Minneapolis 13, Minn.*



NEW CARRIER UNITS INSTANTLY PROVIDE COOLING OR HEATING IN ANY ROOM AT ANY TIME OF THE YEAR

... can be installed for heating only, with slide-in cooling section added at low cost at any future date

... are easy to install—require no ducts or insulated piping

... save floor space—extend into room only 8 inches; need no apparatus room, no cooling tower

... operate at low cost, summer or winter. Can be turned off in unoccupied rooms

... one thermostat automatically controls temperature—gives heating or cooling instantly when needed.

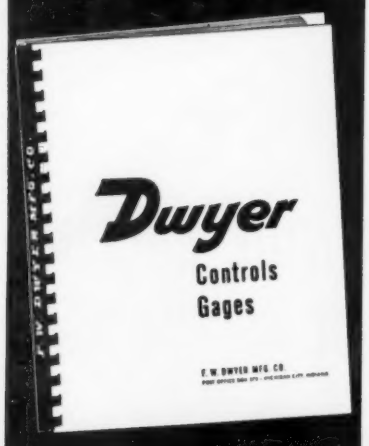
... heating supplied by steam or hot water. Can be all-electric with strip heating or heat pump

Designed to meet the needs of motels, hotels, apartments, hospitals and smaller office buildings, the new Carrier Four-Season Weathermaker* consists of centrifugal fans with a single row heating coil—either steam, hot water or electric strip. A cabinet mounts on the wall over the fan-coil section. The self-contained, air-cooled refrigeration section slides into a sleeve that extends through the exterior wall. A thermostat and 4-position fan switch are included in the fan-coil section to automatically control both heating and cooling. For complete information, call the Carrier dealer listed in the Yellow Pages. Or write Carrier Air Conditioning Company, Syracuse 1, New York.

Reg. U.S. Pat. Off.

Carrier Air Conditioning Company

For the latest in Gages...Controls



NEW

Dwyer

INSTRUMENT MANUAL

Contains:
- Illustrations and complete details of Dwyer
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  - air filter gages
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RECENT TRADE LITERATURE

Continued

Air Pumps

Thirty-two page catalog 561 gives data on rotary positive air pressure and high vacuum pumps, gas boosters, and air motors. Air pumps provide vacuums to 29.9 in. Hg. pressures to 20 psig, and volumes to 162 cfm. Includes details of construction, dimensions, capacities, and performance curves. Models include two and four vane, single and double cylinder, fan-cooled, water-cooled, air-cooled, oil-less, motor-driven, belt-driven, direct-coupled, automatically controlled, integral pump and motor, and accessories. — *Leiman Bros., 102 Christie St., Newark 5, N.J.*

Handling Corrosive Fumes

Thirty-six page catalog F tells how to handle corrosive fumes with fans, air washers, and exhaust systems made of PVC. Includes details on unplasticized Type 1, PVC centrifugal, tubeaxial, and utility fans, and air washers. Presents photo, dimension diagram, performance table, and description for each item. Design and applications of complete exhaust systems are illustrated. — *Industrial Plastics Fabricators, Inc., Endicott St., Norwood, Mass.*

Chemical Process Pumps

Sixteen page bulletin No. 725.1 describes 11 sizes covering a range of 5 to 775 gpm, 10 to 300 ft TDH. Available in ductile iron, 316 stainless, and "Gould-A-Loy 20." Handles a variety of corrosive liquids at temperatures from −350 to 500 F. Includes data on bearing life expectancy, shaft deflection, interchangeability charts and diagrams, performance, application, and dimensions. — *Goulds Pumps, Inc., 225 Black Brook Rd., Seneca Falls, N.Y.*

SC CLAIR COAT

A Superior LAGGING ADHESIVE

Created By St. Clair Rubber Co. for the toughest pipe and duct Lagging applications.

NOTE THESE 10 HIGH SCORING POINTS

FAST SETTING - Sets almost immediately for faster application.

LOW FREEZING POINT - Usable after being frozen solid.

NONFLAMMABLE — With fire retardant dried film.

STRONGEST PERMANENT BOND - Proved by comparative tests.

ONE COAT NEEDED - For sleek, semi-gloss finish.

STEAMPROOF - WATERPROOF By contractors's tests.

NON TOXIC - VERMIN PROOF Will not settle in container.

FINE APPEARANCE - EASILY WASHABLE - Provides long lasting protection.

Also New St. Clair LAP SEALING ADHESIVE #45007

Featuring

FASTEST APPLICATION - No waiting for open time.

ONLY ONE COAT NEEDED

IMMEDIATE TACK - FAST GRAB with STRONG BOND.

FINE BRUSHING CONSISTENCY

WHITE COLOR - No. 45007

TAN COLOR - No. 4570

PERM RATING of .05

NO LAP FAILURES Laboratory controlled quality.

REPLACES STAPLING - BANDING

HEAT RESISTANT to 300° F.

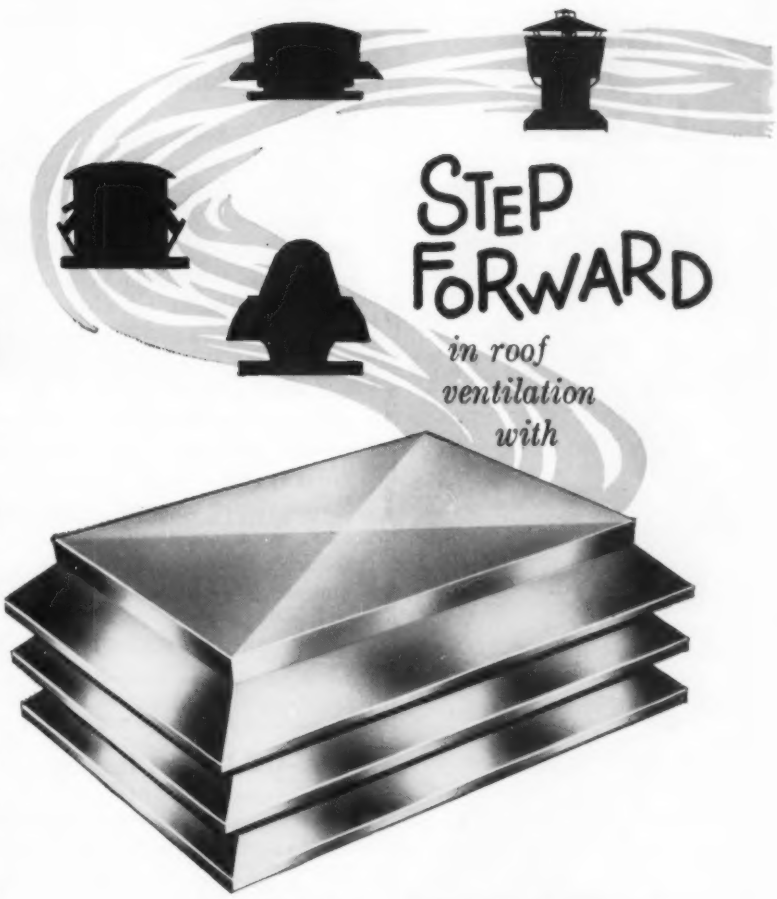
HIGH STORAGE STABILITY Several container sizes available.

Write for literature - prices - samples, of either or both adhesives

ST. CLAIR RUBBER CO.
Empire Bldg.
107 Clifford St. Detroit 26, Mich.

NEW FOR '62

A TOTALLY FRESH DESIGN IN ROOF VENTILATION from PENN!



STEP FORWARD *in roof ventilation with*

THE LINEA

Already winning friends among architects and engineers for its STEP FORWARD age design is the LINEA, truly the first modern roof ventilator for 1962 and the years ahead. Low, graceful and compact, the LINEA exemplifies quality—from its corrosion-free aluminum to its aerodynamically balanced stormproof blades which reduce friction and turbulance of exhausting air.

A significant advantage with the LINEA is that you can specify its universal housings for high efficiency centrifugal duty, axial supply and exhaust, gravity discharge, pressure relief and other applications. With the LINEA, you can solve almost every ventilation problem in aesthetically correct housings.

Step Forward in roof ventilation now by sending for Bulletin L-61 containing complete specifications and working information on the LINEA. Write today . . . or contact your local Penn representative.

PVC

PENN VENTILATOR CO., Inc.

PHILADELPHIA 40, PENNA.

A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

Member of AMCA

Penn Ventilator products are available throughout the Free World. One of many direct factory representatives at your service:

THOMAS A. FOX, HARTFORD, CONN.

AirMaster

LO-BOY
CENTRIFUGAL ROOF EXHAUSTERS

Enhance the Beauty of Building Skylines

Pats. Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- **QUALITY**
- **BEAUTY**
- **PROVEN PERFORMANCE**

Write for bulletin Ha-100 60

AMMERMAN CO., INC.
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.
P.O. Box 182
Stillwater, Minnesota

RECENT TRADE LITERATURE

Continued

56-Frame Motors

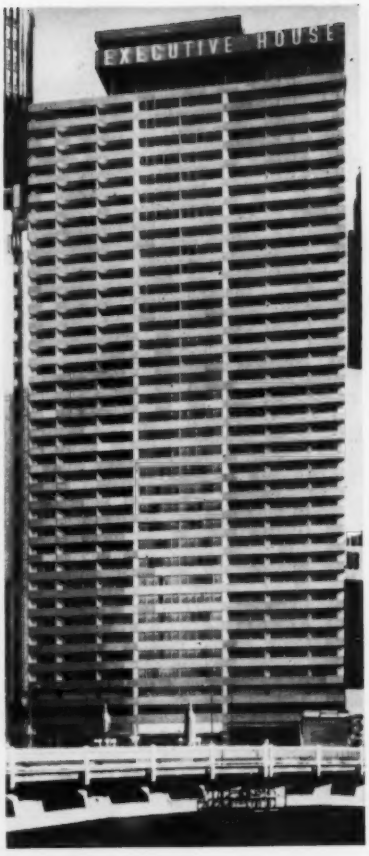
Six page bulletin L-3313A gives information on a-c general purpose motors for driving pumps, high inertia fans and blowers, air conditioners, and other applications. Ratings range from ¼ to 2 hp; open, drip proof, or totally enclosed; single phase capacitor-start or three phase squirrel cage for high starting torque, low starting current operation. Available in all standard voltages and frequencies and with a wide variety of mountings and modifications. Presents selection and specification data, mounting arrangements, performance curves, and lists principal dimensions. — *Kingston-Conley, Inc., Plainfield. N.J.*

Infra-Red Radiant Heating

Two page folder gives data on infra-red electric radiant heater that has a tube life of over 5000 hr, guaranteed. Maximum heat output is reached in 90 sec. Heater has a fused quartz element, semi-parabolic shaped reflectors, and special end reflectors for optimum coverage. Includes information on selection and installation. — *Apextro Products Co., 1821 N. Eastlake Blvd., Los Angeles 31, Calif.*

Insulation

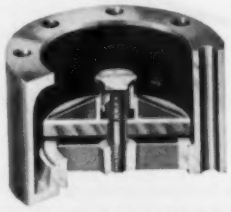
Four page bulletin describes "Elasto-Foam," a polyurethane foam insulation which is applied by spraying or pouring. Can be used on steel, plastics, concrete, or wood. Used continuously on surface temperatures up to 250 F, or intermittently as high as 275 F. Includes application data and a list of general properties. Illustrated with photos. — *Electro Chemical Engineering & Mfg. Co., 750 Broad St., Emmaus, Pa.*



HOW TO CHECK A 4-TON "WHAM"

Two of the four CPV Silent Check Valves in Chicago's new Executive House stand beneath an 8-in. dia. column of water 40 stories high—and permit upward flow only without hammer or chatter. When the pumps shut off, these CPV silent checks close instantly and silently before the 4-ton fluid battering ram can "wham" the valves shut.

CPV stops water hammer by preventing it. That's why the truly SILENT CHECK VALVES are stamped CPV. Specify CPV and be sure.



For the full story and specifications, write for Catalog 600.

CPV

SILENT CHECK VALVES

COMBINATION PUMP VALVE COMPANY
851 Preston St. Philadelphia 4, Pa.

DON'T COMPARE

insul-fil®

WITH ANY OTHER FILL-TYPE INSULATION!

insul-fil Is A Reinforced Hydrocarbon Fill

There's a big difference — a tremendous difference between Insul-fil and all other fill-type insulations for underground piping. Only Insul-fil has the exclusive patented perlite filler that eliminates flow. Insul-fil installations have proven themselves by standing up under all kinds of conditions where other fill-type insulations have failed.

It is a well-known fact that bitumens will flow when subjected to heat or pressure. Even hard bitumens which do not flow will crack when cool.

But Insul-fil, with its perlite filler, is completely different and infinitely more efficient in thermal stability and insulation value. It provides greater structural stability even when used at maximum temperatures.

Perlite Aggregate In INSUL-FIL Makes All The Difference

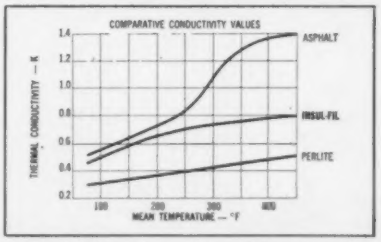
A unique combination of high softening point petroleum asphalt blended with coated inorganic perlite, Insul-fil provides far greater insulation value than any unfilled asphalt. Perlite, made from a volcanic rock which has been crushed, screened and expanded at a very high temperature, is composed of glass-like beads or perls. Each perl contains a maze of "sealed" dead air cells which give Insul-fil its light density and high insulation value. The patented process, developed for waterproofing the perlite, makes Insul-fil far superior in water resistance. In addition, another exclusive Insul-fil development is priming of pipe with Primer #7591, which provides continuous adhesion of Insul-fil to pipe, speeds consolidation, and gives positive protection against corrosion by galvanic action.

INSUL-FIL Most Effective Of All Fill-Type Insulations For Underground Piping

Field installations and all types of conclusive testing prove Insul-fil by far more effective in insulation value.

After Insul-fil is installed and heat is introduced into the lines, the Insul-fil is formed into a homogeneous consolidated mass consisting of a small plastic area of varying thickness at the pipe wall, an accompanying sintered area, and in the lower temperature range an area of unsintered material immediately adjacent to the soil.

Unlike the 100% asphalts, Insul-fil does not crack and craze from thermal shock when the heat is turned on or off and therefore does not provide access for water to the pipe. It is during the critical shut down period of spring and summer when cold pipe is especially subject to corrosion that Insul-fil is so highly water resistant.



Yes! There's a big difference between Insul-fil and all other fill-type insulations for underground piping.

INSUL-FIL Most Economical Of All Fill-Type Insulations For Underground Piping

1 — Comparative cost analysis between Insul-fil and other types of underground conduit proves Insul-fil in place costs substantially less.

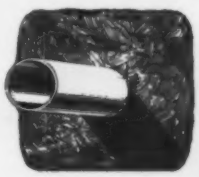
2 — Insul-fil weighs 30% less than other materials, and therefore costs less to ship, less to handle, less to install.

3 — Insul-fil is simple to install. The material is all in one package — 2 cubic feet weighing approx. 57 lbs. Insul-fil Primer supplied free of cost is applied to the surface of the pipe. The loose Insul-fil is poured from the bag around the piping to be insulated, well prodded and tamped, then the trench is backfilled. As simple as that. Heat introduced into the system forms the conduit. Thus labor for installing Insul-fil requires no special skill. The application is a simple, one trade operation.

Insul-fil keeps on saving you money, with its effective control of heat loss and pipe corrosion, eliminating maintenance. Field changes in the installation of Insul-fil underground systems can be made easily, without changes in the material or its application.

Yes! There's a big difference between Insul-fil and all other fill-type insulations for underground piping.

FREE: 40-page Technical Data Book, complete with engineering drawings, heat loss curves, and installation specifications.



insul-fil **COMPANY, INC.**
DIVISION OF: **MIRACLE ADHESIVES CORPORATION**
250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N. Y.

Binks Spray Nozzles

FOR ANY APPLICATION

any size
(orifices from .025" to 1 13/16")

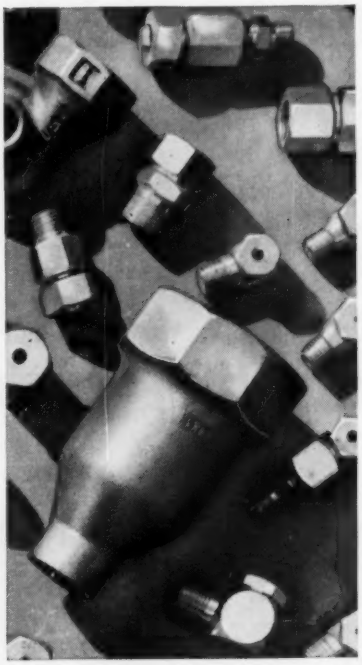
any pattern
(hollow cone, full cone, standard & wide angle, round & flat)

any capacity
(.15 to 230 gallons per minute!)

Your Binks Distributor has the nozzle you need right on his shelf. See him today for complete information on Binks Spray Equipment.

Free: Send for your illustrated copy of Bulletin No. 5900 which describes the broad range of Binks Nozzles available for use in your particular application.

Ask about our spray painting school. Open to all... NO TUITION... covers all phases.



Binks Manufacturing Company 1344-A Carroll Avenue, Chicago 12, Ill.

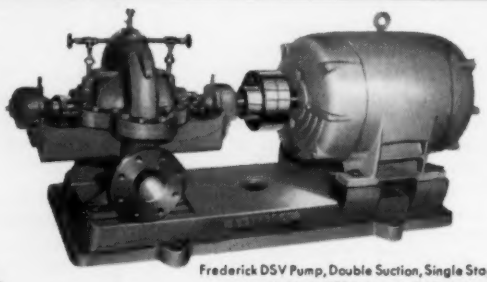
REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

13 96

Binks A complete line of industrial spray nozzles and cooling towers

FREDERICK CENTRIFUGAL PUMPS

for Air Conditioning, water supply, drainage and fire protection.



Frederick DSV Pump, Double Suction, Single Stage
Available in 1½" through 24" discharge

CUSTOM-BUILT FOR EFFICIENT, DEPENDABLE SERVICE

Whatever your air conditioning or other pump needs, you can choose from a complete line of Frederick Centrifugal Pumps—custom engineered and built for you. Exclusive features assure long service life under the most rugged conditions. In fact, many Frederick Pumps have been in service for over 40 years. Easy to install, easy to operate. Prompt repair service and parts available.

Write for Bulletin 104-A describing mechanical features, giving technical data.

Frederick **IRON & STEEL, INC.**
FREDERICK *Established 1890* MARYLAND

EQUIPMENT DEVELOPMENTS

Continued

Duct Heater Assemblies

Four page bulletin GA-61 describes gas-fired units with capacities from 320,000 to 1,200,000 Btu per hr. Self contained units consist of two, four, or six gas-fired duct heaters, plenum chamber, motor driven fan, and a revolving or fixed-type discharge. Available in six downblow models with eight discharge designs. Presents data on outlets, assembly dimensions, capacities, and mounting height and coverage. Illustrated with dimensional drawings, photos, and tables. — *L. J. Wing Mfg. Co., Linden, N. J.*

Sound, Vibration Eliminators

Four page catalog 890 covers line of flexible, wire-reinforced rubber sound and vibration eliminators for pipe lines on air conditioning, heating, and refrigeration systems. Dampens metal-to-metal vibration and absorbs pulsations of the liquid column itself. Also describes new 250 F unit for use on high temperature hot water and on dual hot and cold water systems. Illustrated with photos, line drawings, and tables. — *General Rubber Corp., 70 Summit St., Tenafly, N. J.*

Air Pollution Control

Twelve page bulletin 500 describes latest techniques and equipment for air pollution control. Includes air cleaning precipitators for nuclear subs, automated controls, and high efficiency silicon rectifiers. Shows recent installations of gas cleaning equipment in key industries such as basic oxygen steel plants, paper mills, and electric utilities. — *Research-Cottrell, Inc., Bound Brook, N. J.*

M. S. Smith, president, Buensod-Stacey Corporation, designers and installers of dual-duct air conditioning for Rockefeller Center in New York City.

With 3M Adhesives in world's largest air conditioning system . . .

DUCTS DELIVER COMFORT WITH NO BONDING FAILURE IN 10 YEARS!

"We depend on 3M adhesives and sealers to assure tough, air-tight seals for high velocity hot- and cold-air ducts . . . and to make sure insulation really stays put. We've come to rely on the dependable performance of 3M products, as demonstrated by the Rockefeller Center job with no bonding failures in 10 years!" The report is from M. S. Smith. Over 500 Buensod Dual Duct Systems have been installed, including most of the air conditioning at Rockefeller Center. This world's largest air conditioning system has over 22,000 tons' capacity!

3M Brand Duct Sealer, applied by brush, flow gun or trowel, seals all types of sheet metal joints. It increases duct structural strength, dampens vibration and, when dry, can expand to twice its length without breaking. For insulation, there are 3M Brand Adhesives for every bonding need . . . formulations that withstand heat up to 300° F., water-based adhesives that eliminate fire hazards during application, economical high-coverage formulations for general use.

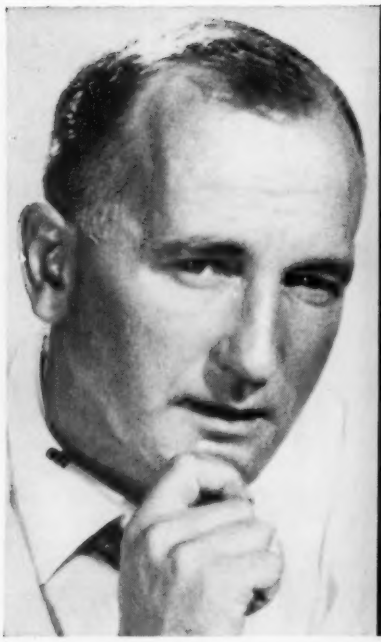
If construction is your business, 3M can serve you! 3M provides the most complete, most reliable line of adhesive products that meet every building need. Besides duct sealer and insulation adhesives, there are 3M products for bonding ceramic, clay, vinyl and rubber tile as well as wood, laminates and other materials . . . for sealing curtain-wall, other external joints and surfaces. For complete information, see Sweet's Catalog, your nearby distributor, or send for the new booklet that explains the entire 3M line. Write AC&S Division, 3M Co., Dept. SBHX-91, St. Paul 6, Minn.

ADHESIVES, COATINGS AND SEALERS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY



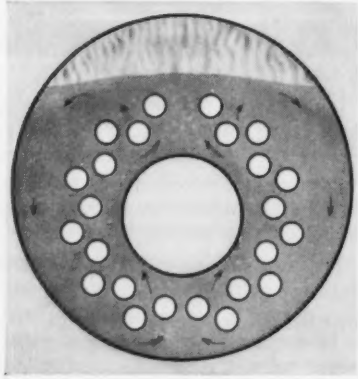
"... it is properly rated as one of the most efficient boilers on the market."

Continental

2-PASS

AUTOMATIC BOILERS

EFFICIENCY of the 2-Pass Continental Boiler means that you get guaranteed 80% minimum efficiency with oil and equivalent with gas fuel. With its simplified 2-Pass design, the Continental delivers sustained high efficiency for the life of the boiler. Stack temperature is guaranteed not to exceed 125°F above boiler water temperature.



BALANCED HEAT DISTRIBUTION. *An important reason for Continental high efficiency and long service life is equal spacing of return tubes around centrally located furnace. Large areas between tubes, furnace and boiler shell provide rapid, unimpeded water circulation, faster heating and unrestricted steam release. No Continental Boiler has ever suffered damage or failed due to "thermal shock."*

Write for latest bulletin of cost-saving features and ratings.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

RECENT TRADE LITERATURE

Continued

Electronic Air Cleaners

Six page catalog 1435 presents information on heavy duty air cleaners with push-button or fully automatic cleaning. Discusses the principles of electronic air cleaning, construction features, selection data, and details on specific application arrangements. Illustrated with photos, line drawings, and tables. — *Westinghouse Electric Corp., P.O. Box* 2278, *Pittsburgh* 30, *Pa.*

Infra-Red Radiant Heating

Four page brochure explains the theory of infra-red radiant heating and its application using electricity as energy source. Illustrated with photos. — *Fostoria Corp., Dept.* 103, 1200 *N. Main St., Fostoria, Ohio.*

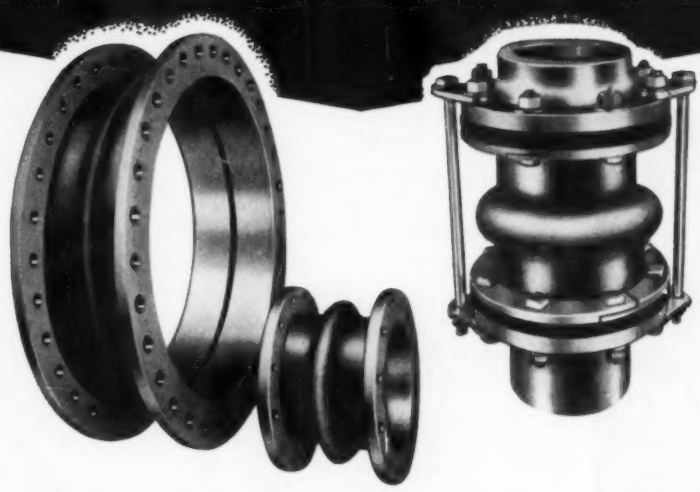
Valves

Twelve page catalog No. 203 describes 292 different valves for ammonia refrigeration, LP gas service, and general industrial use. Includes valves made of ductile iron, globe and angle shut-off valves as large as 6 in. with interchangeable threaded, socket weld, and welding neck flanges; also pressure relief; flow check and hand expansion valves; strainers; liquid level gages; charging hose sets; quick disconnect couplers; and a line of forged steel unions and flanged unions — *Henry Valve Co.,* 3215 *W. North Ave., Melrose Park, Ill.*

Flexible Coupling Adapters

Twelve page catalog 1255 gives information on flanged units for connecting fittings of all types and sizes. Illustrated with installation photos, line drawings, and tables. — *Smith-Blair, Inc.,* 535 *Railroad Ave., South San Francisco, Calif.*

R/M Rubber Expansion Joints and Pipe Solve Piping Stress and Vibration Problems



R/M Rubber Expansion Joints *absorb* pipe movement. They respond to the slightest pressure . . . preventing stress and strain on pipe and fittings that can cause major trouble in ventilating and air conditioning systems. R/M Rubber Joints also *insulate* system components against destructive vibration and noise. Where space is limited or equipment is operated above rated capacity, R/M Rubber Expansion Joints compensate for misalignment due to stress loading. They are available in a wide range of natural and synthetic rubber types for use with gases, fluids or semi-fluids over a temperature range to 200° F.

Condor Flexible Rubber Pipe is ideal for pipe lines subject to noise, vibration, electrolysis, corrosion, abrasion or taking backbends. It will outlast iron or steel—eliminate leaky joints at bends. Let an R/M Distributor discuss with you the advantages of R/M Rubber Expansion Joints, Condor Flexible Rubber Pipe and other R/M rubber products for your heating and cooling applications. Write for Bulletin M685.

R/M POLY-V® DRIVE

Single, Parallel V-Ribbed Belt

- MORE POWER—LESS SPACE
- CONSTANT SPEED RATIO
- ELIMINATES MULTIPLE V-BELT "MATCHING" PROBLEMS
- MAINTAINS GROOVE SHAPE
- LESS BELT AND SHEAVE WEAR
- LESS INVENTORY (2 cross sections instead of 5)

CONVERT TO POLY-V and BE SURE!

CONDOR V-BELTS

For Heavy Industrial Multiple Belt Units

- 40% MORE H.P. AT STANDARD V-BELT PRICE
- PRECISION MADE
- SMOOTHEST RUNNING V-BELTS MADE
- MORE GRIP, LESS SLIP
- LONGER, TROUBLE-FREE SERVICE
- LOWER DRIVE COSTS

NEW R/M CX V-BELT*

For Light Duty Drives

- EXTREMELY QUIET . . . VIBRATION-FREE
- ONLY FULLY-MOLDED, FULLY-JACKETED LUGGED V-BELT
- FOR SMALL PULLEYS
- FLEXIBLE, STRONG, RUGGED
- OUTLASTS OTHERS UP TO 8 TO 1
- NO FLEX-CRACKING
- HOLDS SHAPE AND EFFECTIVE LENGTH WITHOUT STRETCH

*Made for original equipment. Patented.

RAYBESTOS-MANHATTAN, INC.

MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM1005

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

Install Insulation with

TUFF-BOND

Super-Strength Adhesives

TUFF-BOND #7
. . . fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
. . . duct liner adhesive

TUFF-BOND 21-C
. . . clear lap sealer and lap adhesive

TUFF-BOND 21-W
. . . white lap sealer and lap adhesive

TUFF-BOND #6
. . . non-flammable fire-retardant duct liner adhesive; meets Interim Federal Standard #00136.

TUFF-BOND #9
. . . for bonding rigid and semi-rigid plastic foams (polystyrene, urethane, isocyanate, etc.) to themselves and to other materials.

TUFF-BOND #12
. . . high pressure duct sealer

TUFF-BOND QUIK SET
. . . neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

TUFF-BOND GENERAL PURPOSE IMPROVED
. . . all-around adhesive for installing insulation, insulation hangers, etc.

Ask for literature and prices.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 26, ILLINOIS

RECENT TRADE LITERATURE

Continued

Year 'Round Air Conditioners

Catalog C-404 shows adaptations of packaged heating and cooling units for all types of installations. Includes a new roof mounted unit. Fired by gas, oil, or combination gas-oil with a range of 150,000 to 1,600,000 Btu per hr output. Gives specifications and installation data. — *Tjernlund Mfg. Co., 130 S. Tenth St., Minneapolis 3, Minn.*

Variable Speed Sheaves

Sixteen page bulletin 25103 describes motion-control units that embody a design that eliminates freezing and sticking from fretting corrosion. Allows operation to run indefinitely at one speed, and then affords easy adjustment without sticking. "MS" units rated from 2 to 15 hp and "MCS" sheaves rated from 7.5 to 20 hp. Also covers companion pulleys and sheaves, variable speed belts, motion control motor bases. — *T. B. Wood's Sons Co., Chambersburg, Pa.*

LP Gas

Twenty page brochure, *LP Gas for All Industrial and Commercial Uses*, shows the increasing applications of liquefied petroleum gas for heating, drying, thawing, and melting jobs in the construction industries. — *National LP-Gas Council, 1515 Chicago Ave., Evanston, Ill.*

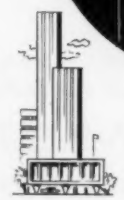
Baseboard Ratings

Twelve page supplement "A" contains all changes, additions, and deletions in the IBR Baseboard Ratings booklet which have become effective between September 15, 1960 and April 30, 1961. —*The Institute of Boiler and Radiator Manufacturers, 608 Fifth Ave., New York 20, N.Y.*

Sterlco®

THERMOTROL

ACCURATE, INDIVIDUAL ROOM TEMPERATURE CONTROL . . . FOR STEAM OR HOT WATER SYSTEMS



Schools, Offices and Apartments

Institutions, Hospitals and Public Buildings

EVEN HEAT
Controls each unit of radiation independently . . . provides heat only when temperature in room or small area falls below Thermotrol setting. Eliminates thermostats and zone valves.

SAVES FUEL
Thermotrol installations often pay for themselves in fuel savings. Prevents overheating and waste of fuel. Excellent for correcting unbalanced systems. Heat used only when and where it is needed.

EASILY INSTALLED
Completely self-contained . . . requires no connection to power supply, or external control device. As easy to install as ordinary radiator valves.

Leaders since 1916

Sterling inc.

5202 W. Clinton Ave., Milw. 23, Wis.

The best name we can think of is

PROPOMATIC

"Propo" for adjustable proportional band . . . "Matic" for automatic valve travel feedback. Put them together – Leslie-PropoMatic® – and you get the new temperature regulator for instantaneous-type heater service.

It works like nothing you've ever seen before. Set the dial for the control band you want, and that's all. Temperature holds steady, even under fast load changes.

No cycling. It's stable! And it shrugs off most dirty steam problems as if they didn't exist. In *effect* it's a pressure-temperature cascaded *control system*— but still, it's a *regulator*—easy to install, and much less in initial cost!

Select from 50F, 100F or 200F powerful, interchangeable thermo elements. Bronze or iron, ½ to 4″, screwed or flanged ends. PropoMatics handle inlet pressures to 150 psi, temperatures as high as 500F.

Engineering Data Bulletin 611 has all the data on PropoMatics. Send for it —no obligation.

LESLIE REGULATORS AND CONTROLLERS

A SINGLE STANDARD OF QUALITY SINCE 1900

Leslie Co., 703 Grant Ave., Lyndhurst, New Jersey

TRADE LESLIE MARK

Manufacturers are using woven wire cloth as the most practical burning surface for gas fired Infra-Red Heaters. Woven wire cloth has proved its efficiency and economy for pre-mix and gravity type burners. It is rugged and reliable—withstands the rigors of expansion and vibration—endures broad ranges of temperature cycling.

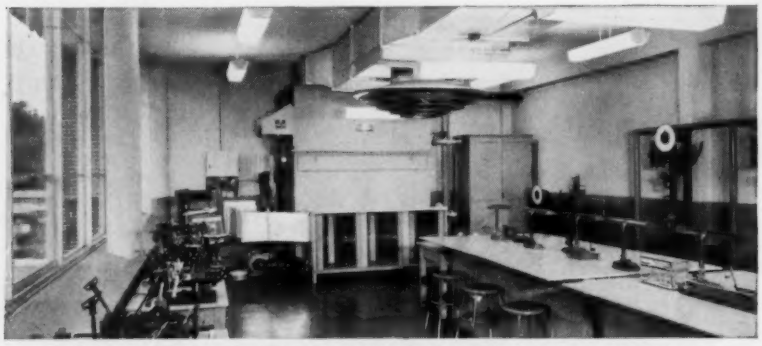
The majority of Infra-Red users of woven wire cloth rely on Cleveland Wire Cloth for their requirements. We have taken combustion engineers' specifications and designed them into efficient woven wire Infra-Red burners. Through research, we are developing new and better applications for woven wire cloth burning surfaces. Let us apply this new technology to your problems.

***Free*—Bulletin 160 containing the full range of square mesh and square opening space cloth.**

CLEVELAND WIRE CLOTH

THE CLEVELAND WIRE CLOTH AND MANUFACTURING COMPANY

3585 E. 78th St. • Cleveland 5, Ohio • Phone DI 1-1832



AIR CONDITIONING THAT KEEPS ITS PROMISE OF PRECISION

NIAGARA Type "A" air conditioners assure that you actually realize all the benefits of precise atmospheric conditioning in your testing laboratory, your "clean room" or in your processing of hygroscopic materials.

This assurance; temperatures controlled to a fraction of a degree, relative humidity held to within 1%, results because this unit, exclusively, can provide saturated air in such compact space. Its extra capacity absorbs sudden peak loads. You hold your standard conditions continuously, without interruption. With its simple, inexpensive control you can vary your standard at will and reach the new condition quickly. Its range, using the Niagara "No-Frost"® liquid below the freezing point of water, is through 140° F. It's reliability is proven. Service records show many machines still precise in operation after 20 years' service.

Write for Bulletin 58 and 122

NIAGARA BLOWER COMPANY

Dept. HP-9, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities

RECENT TRADE LITERATURE

Continued

Control Valves

Sixty-four page bulletin E600 gives information on pneumatic diaphragm and piston actuators, and valve assemblies. Discusses accessories such as valve positioners, handwheels, and electro-pneumatic transducers. Topics discussed include valve body and trim materials, styles of valve plugs, pressure-temperature ratings, maximum pressure drop tables, and performance data including frequency response. — *Fisher Governor Co., P.O. Box* 307, *Marshalltown, Ia.*

Ductile Iron Pipe Fittings

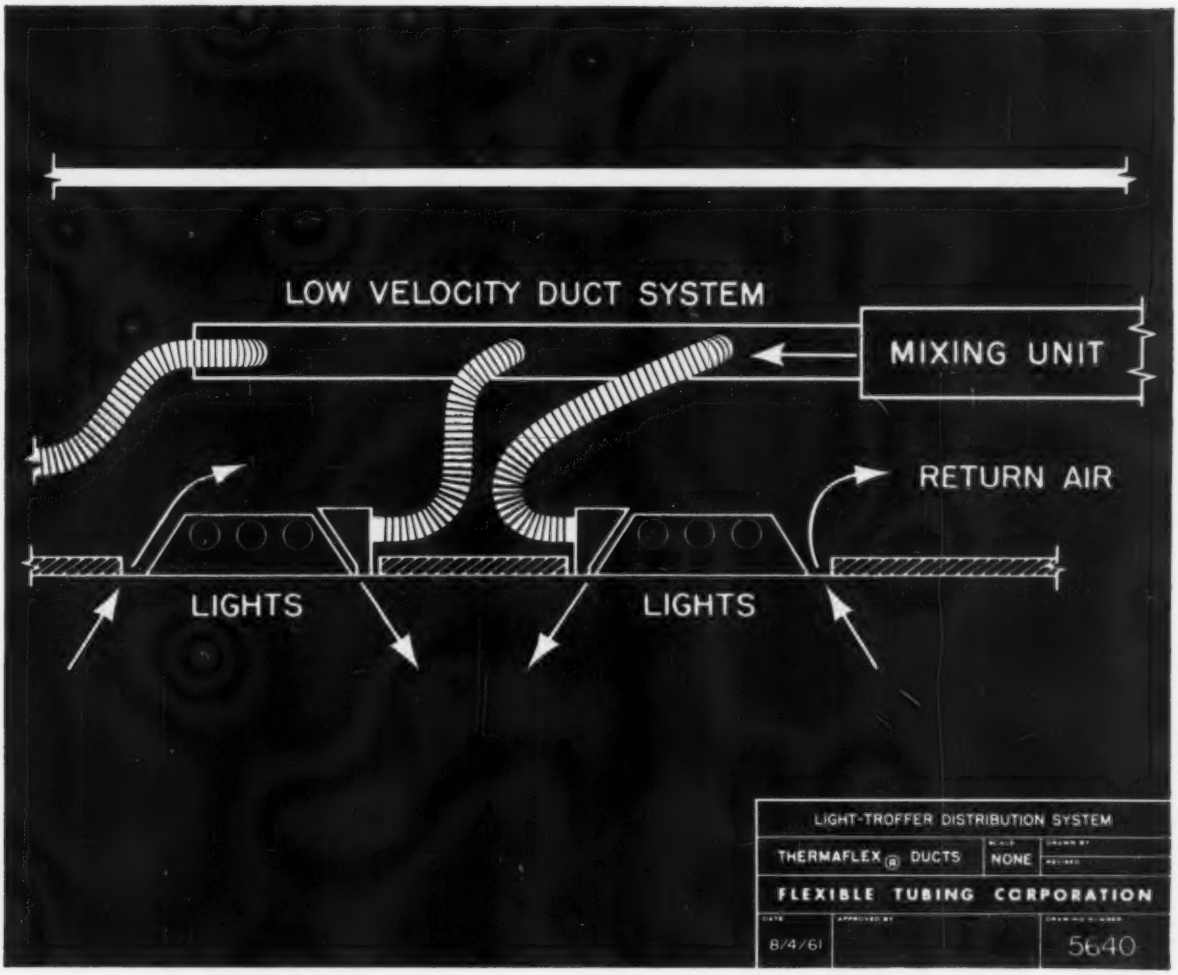
Twelve page catalog 3 PF describes screwed fittings rated from 300 to 2000 psi; pipe lock couplings for 400 and 800 psi; flanges and flanged fittings in the 150 and 300 psi class; as well as hexagon bushings and plugs. All pressure ratings are UL listed. Lists the ASTM, ASM, and MIL specifications met by these fittings. Also includes data on strength, ductility, impact resistance, low temperature transition, corrosion resistance, and lists typical applications. — *The Kuhns Bros. Co.*, 1800 *McCall St., Dayton, Ohio.*

Insulation

Wall chart shows the color-coding system which identifies "Gold Bond" mineral wool insulation thicknesses, and specifies the firm's products which best meet the new "R" Factor Standards. — *National Gypsum Co., Buffalo* 2, *N.Y.*

Color Coding Enamels

Color card contains actual chips of 18 popular colors of firm's fast drying spray type enamels used for color coding pipe and other applications. — *Reynolds Ink, Inc.*, 2075 *E. 65th St., Cleveland* 3, *Ohio.*



In systems combining light troffers and air diffusers . . .

Flexible Tubing simplifies installation of fixtures . . . gives you greater design flexibility

There's a growing trend in air conditioning system design to combine air diffusers with fluorescent light troffers. Advantages: easier installation, maintenance . . . improved ceiling appearance . . . greater design flexibility.

Flexible Tubing is ideal for carrying conditioned air from branch take-offs to mixing units and from mixing units to the combination diffusers!

Unique Flexible Tubing is constructed of a rugged cover permanently bonded to a rustproof spring wire helix. It's lightweight, flameproof, moisture-proof, easy to install. Greatly reduces noises due to vibration.

Specify Thermaflex® for the next system *you* design. For complete product data on Underwriters'-approved Thermaflex, write Flexible Tubing Corporation, 58 New Whitfield Street, Guilford, Connecticut.

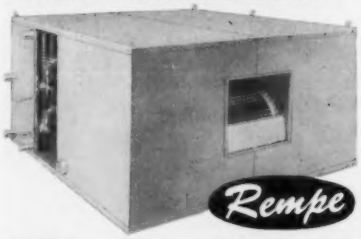
Flexible Tubing Corporation

GUILFORD, CONNECTICUT

Anaheim (Los Angeles) • Hillside (Chicago)

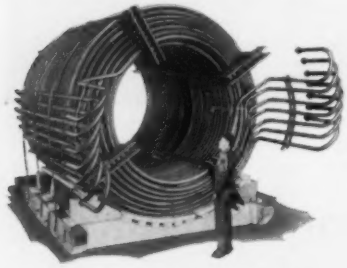
17 miles of Thermaflex will be used in air conditioning system of new Humble Oil Building, Houston, Texas.

REMPE
Heat Transfer Equipment
PACKAGED UNITS FOR
AIR HANDLING



Heating • Cooling • Dehumidifying
Unit illustrated is 15-ton capacity with coil for chilling air to 40° F. and a two row steam reheat coil for tempering air to 70° before leaving unit. Air filters and rack included.
Blower handles 4200 CFM air with 1½ HP motor. Two 7½ ton coil sections may be used together or separately. Steel hot galvanized cooling coils are available for Ammonia . . . Copper tube for Freon or chilled water.

PIPE COILS



No Problem too Complicated for Rempe Engineers . . .
Complicated assemblies or production runs of Coils or Bends from any type of pipe or tubing can be designed to your requirements.
Multiple spiral coil illustrated consists of seven separate circuits of carbon steel tube, electric welded at intermediate joints — Weight 22,000 lbs.
LARGE OR SMALL
WE MAKE THEM ALL

Engineering Data Book
Pipe Coil and Fin Coil Designs. Heat Transfer Coefficients. Get a copy for your library.

REMPE COMPANY
342 N. Sacramento Blvd. • Chicago 12, Ill.

RECENT TRADE LITERATURE
Continued

Make-Up Air Systems

Sixteen page bulletin C-101 describes six basic types of direct gas-fired make-up air units. Available in 40 models with capacities ranging from 5000 cfm with 750,000 Btu per hr to 150,000 cfm with 15,000,000 Btu per hr. Can be mounted on roof, ceiling, or wall. Also includes nine models of burner sections and accessories such as shut-down damper sections, door heat seals, angle filter banks, roof hood air intakes, wall intake louvers, and louver towers. — *Metals Engineering & Mfg. Co., Inc., 8824 Lyndon, Detroit 38, Mich.*

Fans, Class I and II

Forty-four page bulletin No. A-1203 describes "HS" fans, "Series 81." Discusses construction features, available drive arrangements, configurations, and types of drives. Also describes and illustrates specific components such as bearings, dampers, vanes, sound-absorbing bases, and drive speed control devices. Includes capacity tables, line drawings keyed to dimensional data, and typical specifications. — *American-Standard Industrial Div., Detroit 32, Mich.*

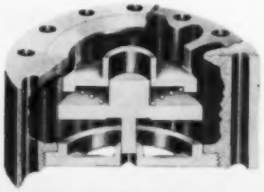
Lubricants

Twenty page plastic-bound booklet gives information on the basic concept of molybdenum disulfide additives employed to enhance temperature capabilities of lubricants. Contains two pages of charts, diagraming the reduction of frictional resistance between moving parts. Also includes sections featuring functional operation, physical properties, and practical applications. — *Hercules Packing Corp., 11061 Walden Rd., Dept. PL1, Alden 1, N. Y.*

On the Boiler Feedwater lines in a large eastern paper mill . . .

Williams-Hager Silent Check Valves provide positive protection against surge pressures and resulting water hammer. Silent in service and rugged in construction, Williams-Hager check valves operate effectively regardless of their installation position.

Write for Bulletins: No. 654 on Valves; No. 851 on Cause, Effect and Control of Water Hammer; No. 659 on Pressure Loss Tests.



WILLIAMS • HAGER
Silent
Check Valves

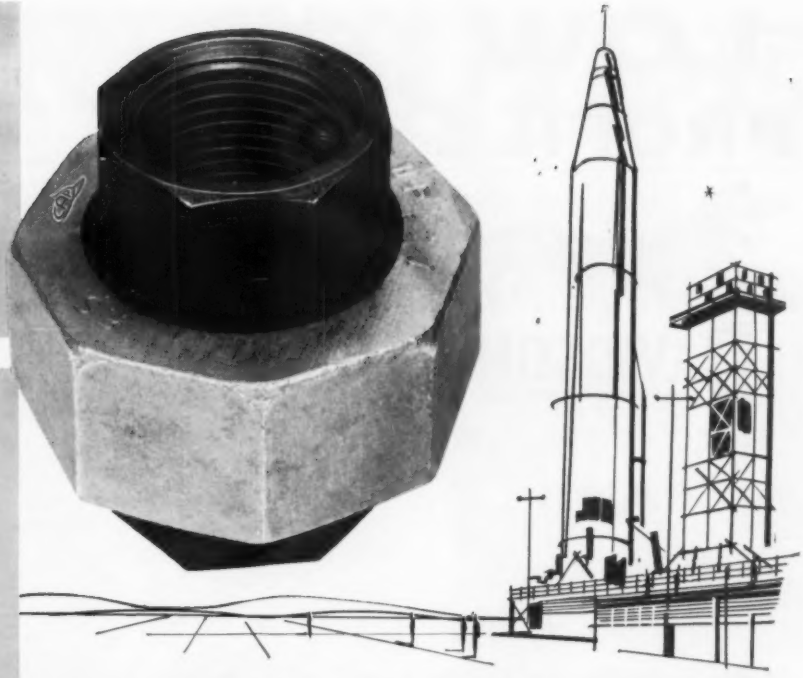
The Williams Gauge Company, Inc.
155 Stanwix Street · 2 Gateway Center
Pittsburgh 22, Pa.
Our 75th Year • 1886-1961

4
EASY WRENCHING
FAST MAKE-UP

3
CLEAN/OVER-ALL PROTECTION

2
POSITIVE SEATING

1
LEAK-PROOF CONNECTIONS



Capitol count down

– INSURES NO FAILURES!

A union is more than a fitting. Installed, it is a refinery . . . a skyscraper . . . an atomic-energy plant! Continued operation depends on it.

And you can count on Capitol forged steel unions . . . because they give you 4-way service insurance.

(1) *Leak-proof connections* assured because Capitol unions have *more* threads, accurately cut and double-checked according to Army-Navy gauging practice. Both hand-tight and pressure-tight threads are checked, two operations instead of the one required for American Standard gauging. The extra threads mean on-the-job assurance of tight installations. (2) *Positive seating* because each union is individually pressure-tested. (3) *Clean/over-all protection*, each male and female part completely phosphate coated; each nut electro-zinc plated. (4) *Easy wrenching/faster make-up* because all three parts have a definite octagon shape.

You get all 4 important advantages at no extra cost when you specify CAPITOL forged steel unions . . . one of the full-line of Army-Navy gauged forged steel fittings. Now more than one million in service . . . and not a single failure.

CAPITOL MANUFACTURING CO.,
Division of Harsco Corporation, Columbus, Ohio.

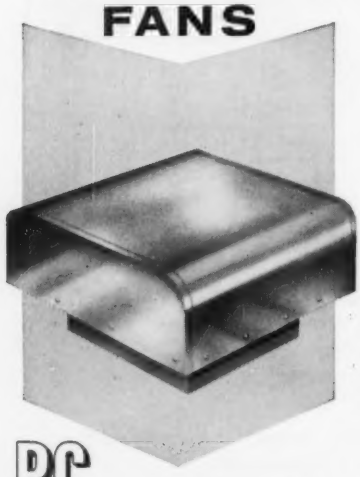
SPECIFY CAP FOR ALL FITTINGS

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

CAPITOL

LOW
PROFILE

DAVIDSON
ROOF EXHAUST
FANS



PC *Pleasing Contour Model*

Designed to "hug the roof", the low-contour PC Model is as much as 40% lower than conventional units.

Capacities up to 50,000 CFM with low velocity.

- Quiet, vibration-isolated operation
- Famous Davidson rugged construction
- NEMA Standard Motors
- Ratings conform to Standard Test Code
- Unconditional performance guarantee

For complete facts about PC Fans and Hyduty SS Fans, write:

DAVIDSON FAN CO.

Dept. E, 213 California St.
Newton 58, Mass.

The original manufacturer of roof fans — Founded 1915

Member AMCA

RECENT TRADE LITERATURE

Continued

Electric Motors

Two page bulletin 300 describes integral (1 through 5) hp, capacitor start, induction run, single phase, open motors. Units have starting torques from 250 to 350 percent and overload capacities averaging 250 percent of full load torque. Motors operate on all standard voltages and frequencies at speeds ranging from 950 through 3450 rpm. Suitable for either continuous or intermittent duty. Includes typical performance curves, and lists NEMA frame assignments by hp and speeds. — *The Leland Ohio Electric Co.*, 1501 *Webster St., Dayton* 1, *Ohio.*

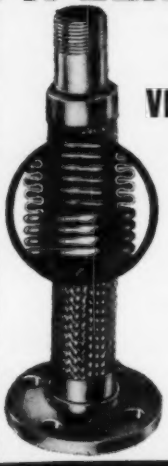
Needle Valves

Four page circular 568 gives data on bar stock steel, and bronze globe and angle valves. Dimensions and weights given in table form, keyed to line drawings. Valves suited for instrument lines, orifice meters, gages, by-passes, and regulation of gases and liquids. Includes both exterior and sectional views. — *Lunkenheimer Co., P.O. Box* 360, *Annex Station, Cincinnati* 14, *Ohio.*

Portable Electrical Testers

Eight page catalog Z-54 lists many types of portable units including: matched a-c and d-c industrial meters; current transformer for use as an a-c multiplier; d-c units for lab use; and multipurpose instruments including a power analyer and circuit tester. Also describes a-c clamp volt-ammeters, ohmmeters, and volt-ohm milliammeters, and combination portable-panel meters in a variety of a-c and d-c types. Illustrated with photos and tables. — *Daystrom, Inc., Weston Instruments Div.*, 614 *Frelinghuysen Ave., Newark, N. J.*

CALM
Jittery
PIPELINES



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Custom-Engineered
FAST to solve your problems.
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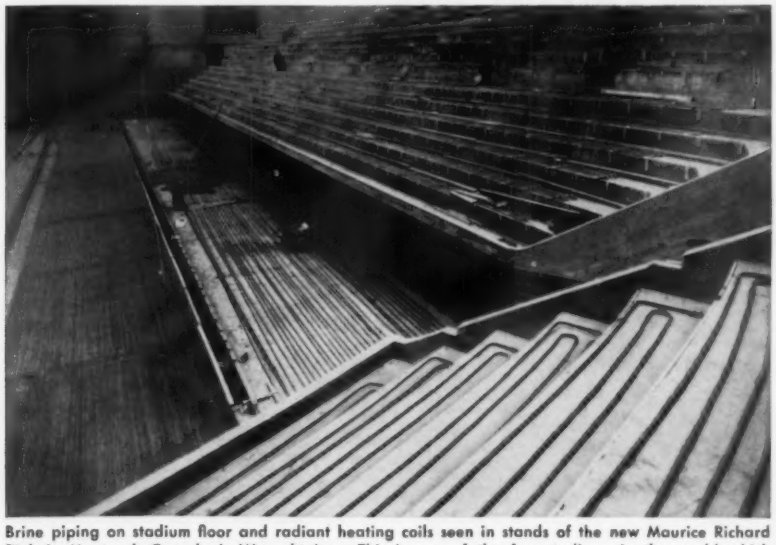
BYERS GUIDE

Tips on Reducing Corrosion Costs from A. M. Byers Company VOL. 2, NO. 9



Brine piping on stadium floor and radiant heating coils seen in stands of the new Maurice Richard Rink in Montreal, Canada is Wrought iron. This is one of the few stadiums in the world which employs radiant heating.

Canadian Hockey Teams Play in Radiant Heated Stadium

Freeze the skating surface, but keep the spectators warm is the job Wrought Iron pipe has to do in the new Maurice Richard Rink in Montreal, Canada. The ice rink piping and radiant heating piping in the sports center were specified Wrought Iron.

These two applications call for the pipe to be buried in concrete. To take a chance using a less durable piping material might be looking for trouble. If either system should fail due to corrosion the concrete would have to be ripped up and the corroded piping replaced.

Service records prove Wrought Iron pipe is a *natural* when installed in inaccessible areas because of its corrosion resistance.

The 1-inch 4-D Wrought Iron was fabricated into sinuous coils for the radiant heating system, laid on 6-inch centers in the spectator section, and then encased in two inches of concrete. Areas adjacent to the rink are also heated.

Hot water, at 110 F, is circulated through the piping network, drawing its heat from a heat exchanger capable of providing 2,500,000 Btu per hour. Supply and return piping is 2½-inch diameter Wrought Iron. This system keeps floors warmer by eliminating cold air currents.

The ice rink used 55 tons of Wrought Iron pipe. Brine solution is circulated through the 1¼-inch diameter pipe spaced on 4½-inch centers, with 8-inch supply and return lines. The piping is buried in 2½ inches of concrete with a terrazzo surface.

For information on how Wrought Iron pipe can reduce both fabrication and maintenance costs in ice rinks and radiant heating, use the coupon.

New Brewery Controls Corrosion With 4-D Wrought Iron Pipe

Electric arc welding of this 12-inch diameter domestic water line for the $16 million brewery recently opened by Carling Brewing Company at Baltimore, Maryland—is speeded through fluxing action of iron silicate fibers in 4-D Wrought Iron pipe. The iron silicate, which melts at a lower temperature than the pure base metal, aids in producing a strong fast weld.

Approximately 60 tons of 4-D Wrought Iron pipe were used for several plumbing and heating services in the new structure—for above ground waste, vent, and cold water lines; downspouts; high and low pressure condensate return, high pressure drip, boiler blow-down, underground fuel oil, and city water lines.

For information on heating and plumbing services with Wrought Iron pipe, use the coupon.

LeBlanc & Montpetit designed the radiant heating system and the ice skating rink while Jean Julien Perrault was the architect. General contractor was Charles Dancereau and the heating contractor was Doucet & Doucet, all of Montreal.

A. M. BYERS COMPANY

PIPE PRODUCTS: Wrought Iron • PVC • Steel
ROLLED PRODUCTS: Wrought Iron — Plates and Bars

A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.
Please send data on items checked:
☐ Ice Rink Bulletin ☐ Radiant Heating Bulletin
☐ Piping for Permanence

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Company _____

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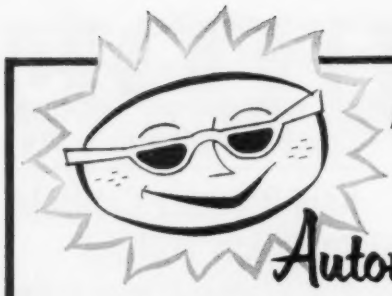

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Automatic Sunshine

to meet big heating demands!

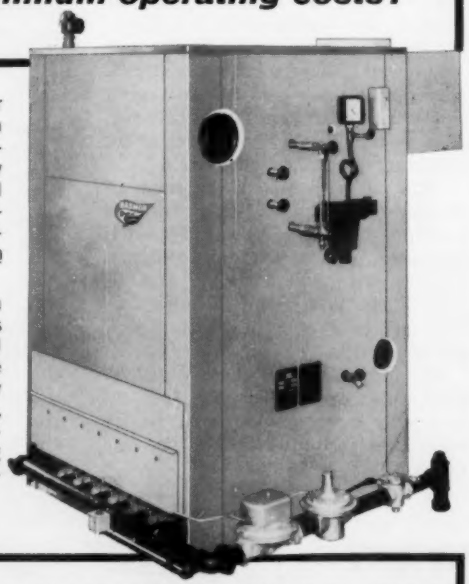
AUTOMATIC SUNSHINE is radiant hydronic heating with a Basmor Boiler. The healthful even, sun-like warmth of heat by radiation, whether from radiant baseboard, panels, convectors or conventional radiators.

Basmor Gas-Fired Boilers in sizes to meet commercial, institutional and industrial heating demands efficiently and economically. For all steam, hot water or vapor systems, and large volume water heating by the indirect method.

engineered for fast installation, simplified servicing, minimum operating costs!

Basmor 400 Series (Water Boiler shown above) in ten sizes from 375,000 to 1,050,000 BTU input. Top combustion efficiency with cast drill port burners and finest controls. Maximum utilization through patented "staggered heat travel" cast iron section design.

Basmor 600 Series (Steam Boiler at right) in thirty-six sizes from 725,000 to 5,800,000 BTU input, permits "tailored-to-the job" selection to accurately meet heating requirements. Yes, you can rely on Basmor Automatic Sunshine for big heating demands! Write for complete information.



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LaPorte, Indiana

Basmor-Little Boilers, Furnaces, Gas Heaters, Water Heaters, Incinerators

RECENT TRADE LITERATURE

Continued

Motor Drives and Couplings

Twenty page bulletin No. 70 describes "Flexidyne" dry fluid drives and couplings. Eight stock drives and 11 stock couplings are listed for fractional to 1000 hp requirements. Includes tables of weights, dimensions, and recommended V-belt drives. Illustrated with installation photos, product photos, and engineering drawings. — *Dodge Mfg. Corp., Mishawaka, Ind.*

Integral Motors

Six page bulletin L-3314A gives data on open drip-proof motors in single phase models to 5 hp and three phase models to 10 hp; totally enclosed motors in single phase models to 2 hp and three phase models to 3 hp. Contains selection and specification tables, mounting-arrangement drawings, speed-torque curves, dimensions, and special use motors. — *Kingston-Conley, Inc., Plainfield, N.J.*

Tubular Products

Four page bulletin PC-61 provides information on coils, bends, and fabricated piping for heating and cooling liquids, solutions, vapors, and gases. — *Rempe Co., 340 N. Sacramento Blvd., Chicago 12, Ill.*

Expansion Valves

Six page bulletin 262-B describes four standard expansion valves for air conditioning and other applications in either original equipment installations or for replacement purposes. Includes a direct replacement chart listing valves produced by three other manufacturers now replaceable by firm's "Detroit 900" unit. Illustrated with photos, line drawings, tables, and charts. — *American-Standard Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.*

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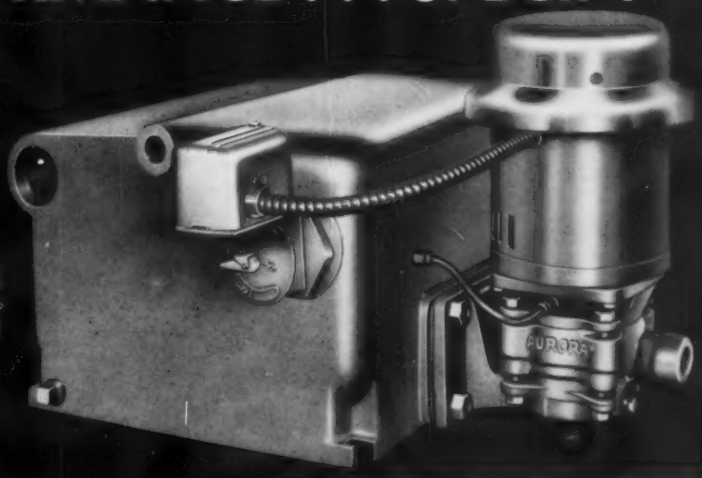

Capacities to 15000 EDR–To 23 GPM

- Low NPSH . . . smooth ultra-quiet operation . . . impeller design with curved inlet blade tips that minimize shock loss as the liquid enters the impeller.
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Aurora Pump specialists are always available for consultation on your requirements

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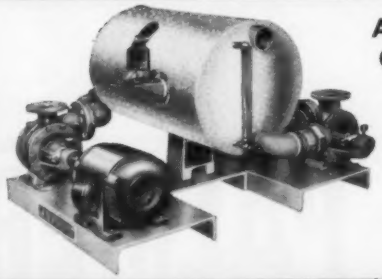
Capacities to 100,000 EDR 150 GPM

Ideal for applications where return is extremely low or below floor level.



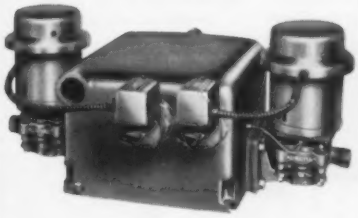
APCO HORIZONTAL UNITS

Capacities to 100,000 EDR 150 GPM

With automatic range adjustment, equalized pressure, and the many advantageous features of APCO Turbine Type Pumps

TYPE C HEAVY DUTY UNITS

Capacities to 150,000 EDR 225 GPM



For high capacity or heavy duty applications. Packing Boxes on pumps optional when desired.

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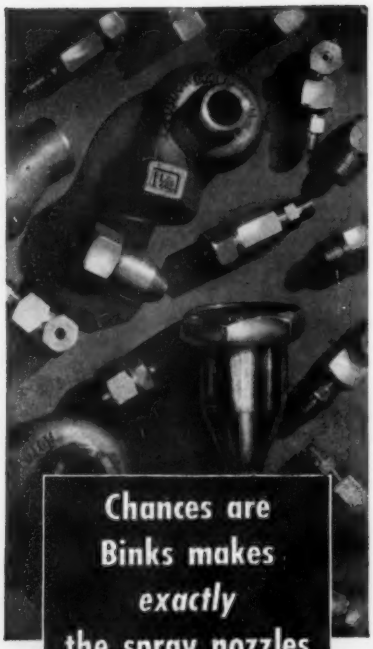

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for washing, cooling, processing, humidifying, dehydrating and hundreds of other applications.

Whatever your production or process requirements...you'll get the *right* spray nozzles quicker by calling Binks.

There is a size and spray pattern for every purpose...with nozzles cast or machined from standard or special corrosion-resistant metals and materials.

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RECENT TRADE LITERATURE

Continued

Acoustical Turning Vanes

Four page bulletin ST-61B describes acoustical turning vanes for installation in square corner ducts. Minimizes turbulence and expansion losses in the elbow, and also provides supplementary attenuation at critical points. Line drawings show cross section of the vane and a typical duct system. Performance results are given in chart form. — *Sound-Control Products Co., P.O. Box* 11179, *Station A, Palo Alto, Calif.*

Venting Valves

Four page bulletin describes venting valves for steam heating systems. Units are made with five sizes of air outlets. Gives installation instructions with line drawing illustrations and photos. — *Gorton Heating Corp., Cranford N. J.*

Induction Heating Unit

Four page folder DM-157 describes a 400 cycle induction heating unit and tells how it simplifies the preheating and stress relieving of arc welded pipe joints. Automatic operation by means of strip chart program controller is also described. Photos show typical installations. — *Hobart Brothers Co., Troy, Ohio.*

Zone Control Valves

Four page bulletin describes "Zone-A-Trol Straight Flo" valves for hydronic heating systems. Provides piping diagrams for zoning various types of systems and illustrates step by step how to install different types and sizes of valves available. Illustrated with photos, line drawings, and tables. — *Econo Products Co., Div. of Viking Instruments, Inc., East Haddam, Conn.*

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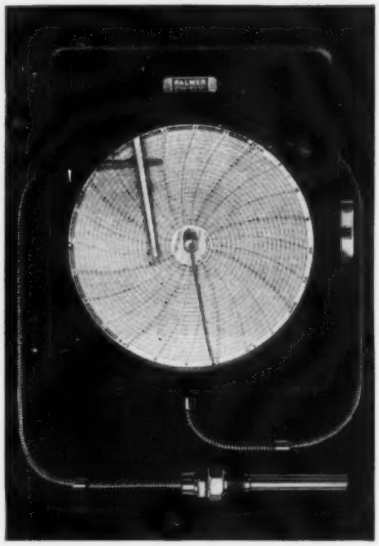
MERCURY ACTUATED RECORDERS

Into this modern Mercury Actuated Recorder has gone all the skill of Palmer Master Craftsmen



Readings are clearer, smoother and more precise than ever thought possible. In fact readings are so amazingly improved that maintenance is never needed under normal uses.

Recording Thermometers feature twelve inch die-cast aluminum case with black wrinkle or white satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges: —40 to 1000°F. or Equivalent in °C.

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Consult your Classified Directory

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Mfrs. of Industrial Laboratory, Recording and Dial Thermometers
Cincinnati 12, Ohio

"There is an absolute uniformity whether it be heating or air conditioning, and last but not least, the maintenance is negligible."

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February 11, 1961

Mr. Howard W. Harper
De Gelleke Company, Inc.
4040 North 126th Street
Brookfield, Wisconsin

Re: The Burgess-Manning Installation at the new Morse Annex, Beloit Municipal Hospital

Dear Mr. Harper:

The complexity of hospital construction demands that a great deal of care and judgment be exercised in the selection and use of materials, therefore, after careful deliberation a Burgess-Manning ceiling was selected for installation throughout the new building at the Beloit Municipal Hospital.

The new building included 45 Patients' Rooms, Surgery and Recovery Areas, Hydro-Therapy, Occupational Therapy, complete Laboratory and complete Radiology Department.

The installation relative to this particular building has proved itself in each of the following procedures:

1. We found the material simple and easy to install, particularly with respect to the various other mechanical work, such as recessed lighting, etc.
2. The radiant ceilings provided additional floor space and also flexibility of hospital furniture arrangement.
3. There is an absolute uniformity whether it be heating or air conditioning, and last but not least, the maintenance is negligible.

The above installation has been in operation through four heating and air conditioning seasons and we are convinced that the statements made herein are true, in fact, we are specifying the material on another larger and even more complex project.

Sincerely yours,
CARL LLOYD AMES & ASSOCIATES, INC.

The "in-use" performance benefits of the Burgess-Manning Radiant Heating, Cooling and Acoustic Ceiling for hospitals and institutions are convincingly demonstrated by this letter from Carl Lloyd Ames & Associates, Inc. . . . who, because of their four years proven experience with the Burgess-Manning Radiant Ceiling "are specifying the material on another larger and even more complex project."

The Burgess-Manning Radiant Ceiling installation at the Beloit Municipal Hospital is but another in the scores of hospital installations* . . . where maximum human comfort—a primary consideration—is completely achieved through the Burgess-Manning Radiant Ceiling.

In fact, no other ceiling installation provides heating, cooling and sound absorption with equal advantages of structural simplicity . . . minimum maintenance requirements . . . mechanical and decorative design flexibility . . . and, operational efficiency.

When you specify the Burgess-Manning Radiant Heating, Cooling and Acoustic Ceiling for new hospitals or hospital additions . . . **your hospital is better . . . your budget no bigger.**

Today . . . write for complete literature, specifications, etc. Ask for Bulletin 138-3G

* list on request

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Your letterhead request will bring you the Burgess-Manning "b.t.u." . . . a monthly publication providing information, new trends and technical data on Radiant Heating, Cooling and Acoustic Ceilings for hospitals, schools and buildings.

3 Heating Cooling Acoustic

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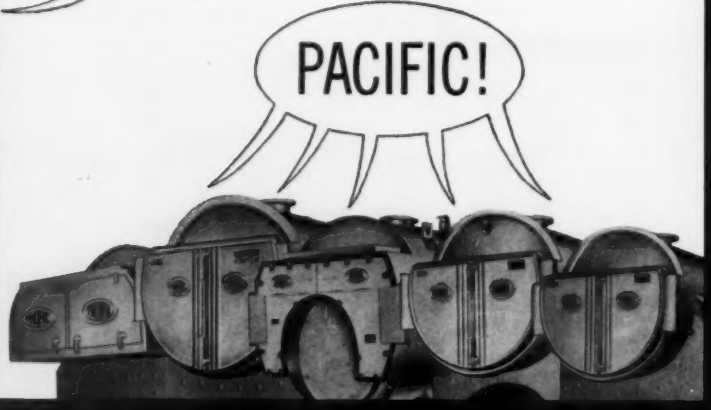
PACIFIC!



Pacific specializes in big steel boilers. Has designed and built them for almost 50 years . . . they are installed in all parts of the world. With Pacific you get the largest selection of low pressure steel heating boilers. You get more experience, too. Every Pacific man is a boiler expert. There's a Pacific Representative in your area. Call him for your next boiler.

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VALVES AND PIPING · ELECTRONIC CONTROLS
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RECENT TRADE LITERATURE
Continued

Centrifugal Roof Ventilator

Four page bulletin CV61 contains complete engineering data on the "Centridyne" low silhouette unit certified by AMCA. Gives performance and construction specifications. Cutaway photo and diagrams show details of aerodynamically designed extruded aluminum discharge vanes and low noise features. — *Western Engineering & Mfg. Co., P.O. Box 66455, Los Angeles 66, Calif.*

Make-Up Air Systems

Eight page bulletin DF-200 *Design Considerations for Make-Up Air Systems* discusses the need for make-up air systems, how to plan and design them, how to select component equipment, and the basics of designing their control arrangements. A separate section describes gas-fired furnaces and blower assemblies. — *Reznor Mfg. Co., Mercer Pa.*

Military Air Conditioners

File folder with data sheets describes units designed specifically for mobile or stationary applications in the military and military electronics industry. Four series available, including a mobile two-wheel trailer mounted unit series. — *Airflow Co., 400 S. Stonestreet, Rockville, Md.*

Vacuum Heating Pumps

Four page bulletin S153 covers "VAC" line of vacuum pumps. Units have individually sized and separately controlled vacuum and condensate pumps. Includes performance and selection tables. Gives information on sizing. Illustrated with photos, and dimensional drawings. — *Domestic Pump & Mfg. Corp., Shippensburgh, Pa.*

STEEL PIPE BY WHEELING

SO EASY TO USE... SO HARD TO ABUSE!

The name "Wheeling" on the pipe you use is mighty important. For it's positive assurance that the pipe you use is "*so easy to use . . . so hard to abuse!*" Here's why:

So easy to use because Wheeling Continuous Weld Steel Pipe always has even wall thickness and accurate circumference. It cuts . . . bends...welds...and threads easily, quickly every time.

So hard to abuse because Wheeling Pipe is made from uniform, top-grade steel . . . and produced in America to *exacting* American standards. You are sure that Wheeling Steel Pipe, both black and galvanized, will withstand the rugged abuse that's the natural part of every construction job.

Order a supply of Wheeling Continuous Weld Steel Pipe from your Wheeling Jobber this week. Wheeling Steel Corporation, Wheeling, West Virginia.

"MADE IN U.S.A." is stenciled on Wheeling Pipe for your protection!

IT'S WHEELING STEEL!

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Available in Gravity or Vacuum Types.

Accurate to within 1% from zero to rated capacity regardless of system pressure.

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Write for catalog #25 and name of nearest distributor.

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2912 E. Woodbridge • Detroit 7, Mich.

RECENT TRADE LITERATURE
Continued

Flexible Pipe Connectors

Sixteen page manual AM-9 is a guide to flexible pipe connectors. Five major topics discussed are: analysis; interpreting engineer's specifications; avoiding connector failures; proper installation; and a checklist for selection. Illustrated with application photos, and has tables, drawings, and a series of "do and don't" cartoons. — *Allied Metal Hose Co., 3746 Ninth St., L.I. City 1, N.Y.*

Valves

Twenty-four page catalog MV-615 covers 28 categories of valves and pictures 74 individual units. Valves include angle, check, circulator, convector, corner, gate, globe, and others. Illustrated with dimensional drawings and tables. — *Marsh Valve Co., 108 Brigham St., Dunkirk, N.Y.*

Relief Valves

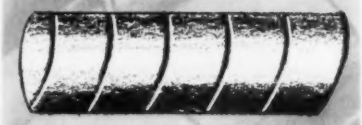
Bulletin L-4317A describes two series of units. Recommends series "No. 460" for pressure protection, and series "No. 503" for automatic temperature-pressure protection. Both are constructed with heavy red brass bodies, stainless steel control spring, special bibb washer, and test lever. Both are AGA listed. — *Mansfield Sanitary, Inc., Perrysville, Ohio.*

Submersible Pumps

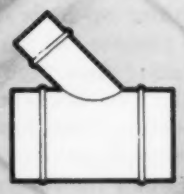
Eight page form 646 describes units with 1/3 through 3 hp ratings. Available in two series: "SL" has capacity of 9 gpm; "SH" has capacity of 20 gpm. Contains performance curves and charts, and selection and specification charts. Also includes a list of accessories. Cutaway photo has names of parts listed. — *Decatur Pump Co., 1 Elk St., Decatur, Ill.*

AMMCO

Sound
Absorbers



Helix-
Lockseam Pipe



Fittings

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MANUFACTURING COMPANY
601 FIRST AVENUE
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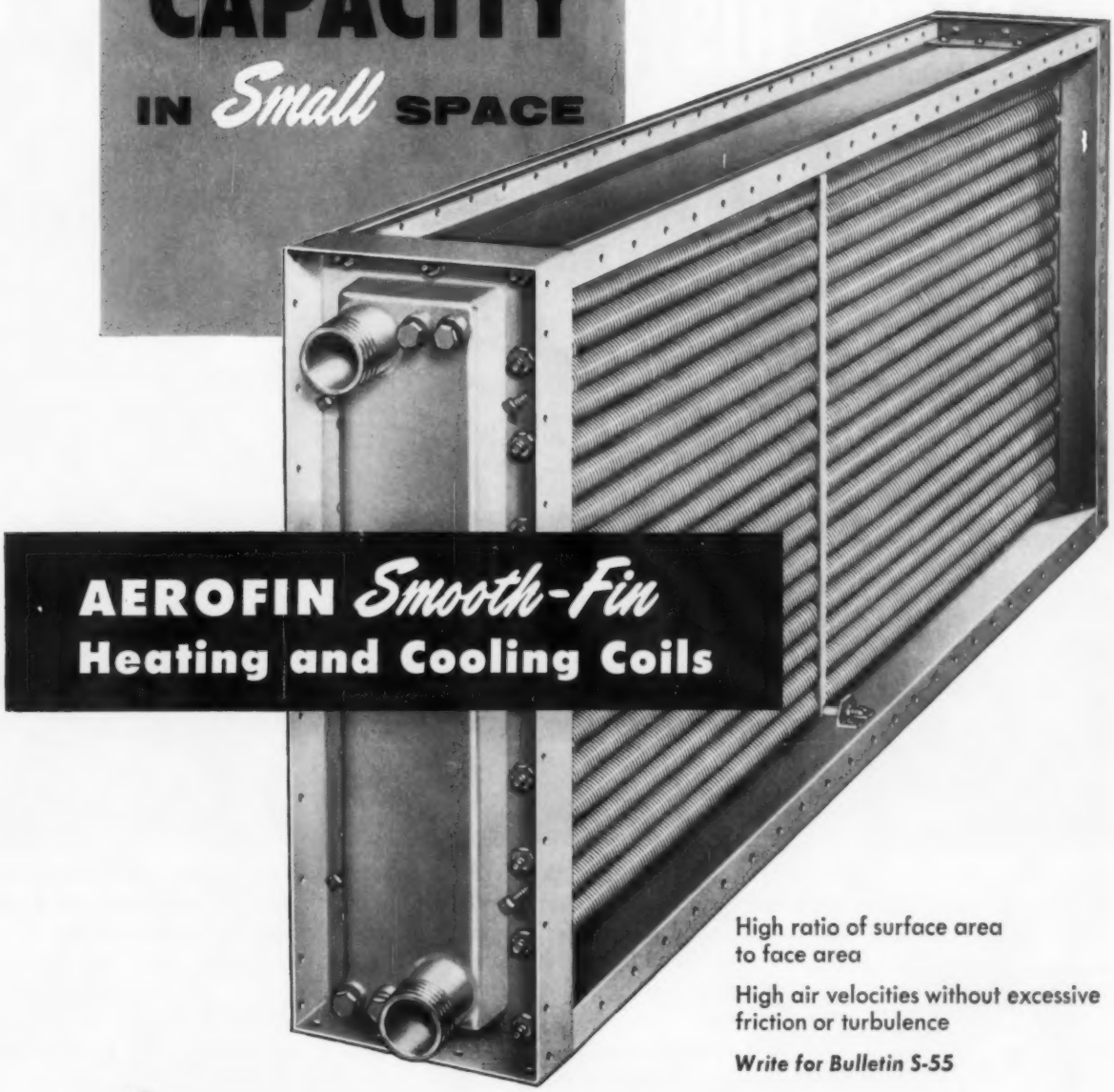
BIG CAPACITY IN *Small* SPACE



AEROFIN *Smooth-Fin* Heating and Cooling Coils

High ratio of surface area to face area

High air velocities without excessive friction or turbulence

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AEROFIN CORPORATION

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Aerofin is sold only by manufacturers of fan system apparatus. List on request.

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During just four short days, the cream of the nation's purchasing influence will be looking at... and looking *for* the latest equipment produced by over 200 national air conditioning, heating and refrigeration manufacturers.

Surveys of past ARI Shows prove that 80% of those attending were directly responsible for purchasing. Of these, 40% were either ready to buy or were persuaded to make purchases for their companies during the Exposition. These are the selling days you can't afford to miss.

Here's your chance to meet and talk to industrial and commercial buyers, contractors, dealers, distributors, manufacturers, wholesalers, and engineers from every phase of this gigantic industry.

ARW, RACCA, RSES, ARI, NWAHACA and WACIA will all be helping to make this 12th National ARI Exposition the biggest and best in history. So, don't let this greatest sales opportunity pass you by... make it pass your booth by being✱"on-the-spot"! *Make space reservations now!*

CONTACT: George E. Mills, SHOW DIRECTOR

12TH NATIONAL EXPOSITION AIR CONDITIONING, HEATING & REFRIGERATION INDUSTRY • FEBRUARY 12-16, 1962

1346 Connecticut Ave., N.W., Washington, D.C.
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The MARSH way is the SURE way—

You'll have a new conception of how *uniformly good* radiator valves, traps and vents can perform when you make the job Marsh all the way through.

Take the Radiator Valve and Trap illustrated here, for instance:

The Marsh Radiator Valve is *truly* packless—not just *called* packless. This valve has no "packing" whatever... instead, the ingenious Marsh annular mechanical seal that keeps it drip tight throughout its far longer life.

And Marsh Radiator Traps are equally sure-footed... have the famous Marsh Diaphragm—extremely rugged, but so sensitive that it never fails to close tight on steam, yet opens instantly to pass condensate and air at only a few degrees below closing temperature.

Yes, the Marsh way is the sure way... Valves, Traps, Vents, F & T Traps, designed, built and tested to give lasting satisfaction in the Marsh tradition. Ask for up-to-date Heating Specialties Catalog 76-H.

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Division of Colorado Oil and Gas Corporation
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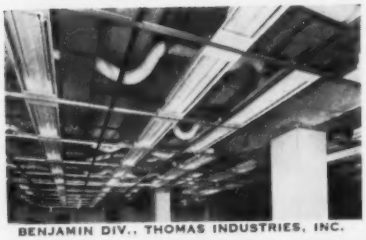
Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.
Eastern Seaboard Warehouse: Marsh Instrument Company, 1209 Anderson Ave., Fort Lee, N.J.

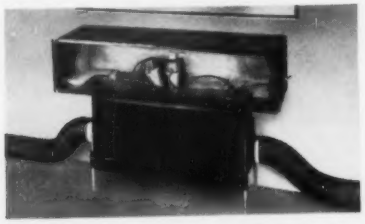
MARSH *Heating Specialties*
SINCE 1865

WHICH IS WHICH?

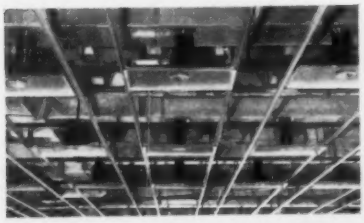


BENJAMIN DIV., THOMAS INDUSTRIES, INC.

1 ☐ HIGH ☐ MEDIUM ☐ LOW VELOCITY



2 ☐ HIGH ☐ MEDIUM ☐ LOW VELOCITY



3 ☐ HIGH ☐ MEDIUM ☐ LOW VELOCITY

ALL THREE USE

WIREMOLD®

AIR DUCT

The most versatile supply duct for air conditioning systems, Wiremold Air Duct also saves time on the job. The result is the lowest installed cost. Send for full information.

Answer: (1) low, (2) high, (3) low.

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Send latest literature.

NAME

COMPANY

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RECENT TRADE LITERATURE — *Continued*

Insulation

One page description sheet gives information on "Hewfoam" rigid urethane foam insulation. Product's solvent, heat, and moisture resistance combines humidity control with temperature control. Also absorbs sound. — *H. E. Werner, Inc., 2990 Industrial Blvd., Bethel Park, Pa.*

Steam Coils

Thirty-two page catalog 305 gives data on type "5" steam coils. Units feature staggered tube design, copper tube headers, mechanical pressure bond, and rippled-corrugated fins. Includes information on coil selection and performance, and piping data. Illustrated with photos, charts, diagrams, and tables. — *McQuay, Inc., 1600 Broadway St., N. E., Minneapolis 13, Minn.*

Flexible Cushion Couplings

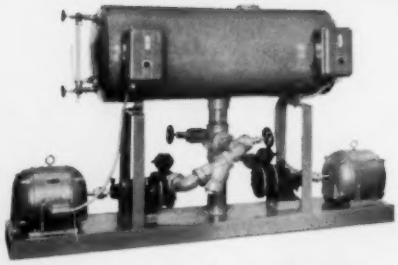
Twenty-four page bulletin 901B describes units that absorb vibration and compensate for all combinations of shaft misalignment and end float. Three types available: standard, high speed, and flywheel. Illustrated with photos, tables, and dimensional drawings. — *Dodge Manufacturing Corp., Mishawaka, Ind.*

Centrifugal Pumps

Eighteen page bulletin G-2971 gives data on installing, servicing, and maintaining centrifugal pumps. Information includes storage, foundation construction, alignment, piping, priming and starting, lubrication, trouble shooting, and internal inspection. Each step is accompanied by a descriptive photo. — *Worthington Corp., Harrison, N. J.*

EAGAN BOILER FEED UNITS

. . . give you 5 BIG BENEFITS



EAGAN Packaged Units have a heavy steel Receiver above the pump to prevent flashing when the traps begin to leak. The Receiver has excess capacity against flooding during surges not relieved by boiler demand and the pumps have a generous reserve capacity.

Single or duplex EAGAN models are available in capacities to 100,000 sq ft. at 200 psi. Straight line arrangement of the duplex unit saves space, provides easy maintenance. Repair or inspection of one unit can be made without halting operations.

Write, wire or phone for more details on EAGAN Boiler Feed Units to suit your requirements.

1. You get economy because an EAGAN unit combines return of Hot Condensate with Boiler Water Make-up.

2. Your fuel costs are lower because fresh water is raised to about 140° requiring less heating.

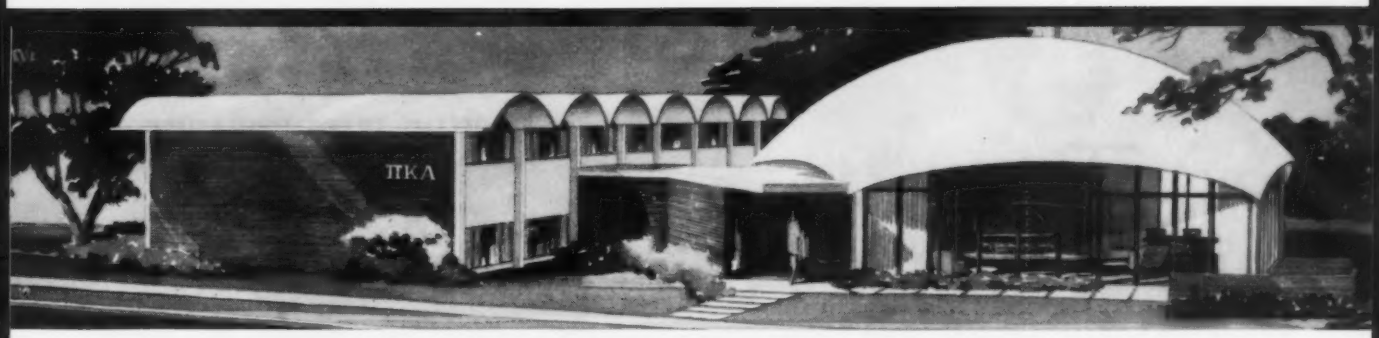
3. You reduce maintenance since reusing condensate means less water treatment, less boiler scale.

4. Your boiler capacity is increased since less heat is required to make steam from hot water than cold.

5. In addition, you minimize boiler tube and plate strain because of tempered return.

Walter H. Eagan Co., Inc.

2336 FAIRMOUNT AVE., PHILADELPHIA 30, PA. CEnter 6-2300



This free-span dome, housing the fraternity chapter rooms and recreational facilities, has glass walls which have a greater heat loss than solid walls. Radiant heating was chosen since it heats uniformly and holds temperatures for longer periods of time.

SPANGRID Steel Pipe radiant heating system serves Denver's first Geodesic Dome structure

The Geodesic Dome is a new architectural form, and the Pi Kappa Alpha Fraternity House at the University of Denver is one of the first of this type in the United States.

SPANGRID uniformity helps speed installation

Over 4,000 ft. of SPANGRID Steel Pipe was fabricated for the radiant heating system on the job by two men in less than 60 hours. Pipe was bent on a hydraulic bender with no damage to pipe, weld or finish. The 21-ft. sections were easily welded into the grid and the system was subjected to a 100 psi hydraulic test for 24 hours.

Buy SPANGRID, get quality

In any radiant heating, snow melting, ice rink or refrigeration installation, SPANGRID Steel Pipe can give you top job-site performance, assure years of trouble-free service. Try it! Your local Spang Distributor will be glad to serve you.

SPANGRID Steel Pipe is one of the many fine steel products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

Architect: Thomas E. Moore, Denver, Colorado
General Contractor: Hugh-Hyder Construction Company, Denver
Heating Contractor: Builders Heating & Air Conditioning Company, Denver
SPANG Distributor: Central Pipe & Supply Company, Denver

ARMCO National Supply Division

SPANGRID Steel Pipe is bent hydraulically. Pipe rests on pea gravel based on 2-inch concrete and is covered with 3-inch finished slab.

Who's Who

The first edition of "Who's Who in Certified Performance Ratings" is now available to users and specifiers of air moving equipment. This new publication of the Air Moving and Conditioning Association meets the recognized need for an official directory of manufacturers and products licensed by AMCA to use the Certified Ratings Seal.

in Certified

The 54-page directory contains essential product identification data on all air moving devices which have been tested and rated for performance in accordance with the rigid requirements of the AMCA Certified Ratings Program. Revised issues will be published periodically.

Copies of Bulletin 261A, "Who's Who in Certified Performance Ratings" are available from: Air Moving and Conditioning Association, Inc., 2159 Guardian Building, Detroit 26, Michigan.

Ratings?

RECENT TRADE LITERATURE

Continued

Gas-Fired Equipment

Thirty-two page bulletin explains "The Control of Draft in Gas-Fired Equipment." Explores the more common draft-related problems such as draft shortages, draft excesses, boiler capacity losses, dual-fuel installations, converted equipment, and automatic switches. — *Conco Engineering Works, Inc., Field Control Div., Mendota, Ill.*

Gas Regulators

Forty page form ADC 705C gives data on industrial gas regulators. Provides quick-reference charts which indicate the range and variety of units. Explains types of gases and their chemical and physical properties. Illustrated with tables, line drawings, photos, and charts. — *Air Reduction Co., Div. of Air Reduction Co., Inc.,* 150 *E. 42nd St., New York* 17, *N.Y.*

Indicators, Controllers

Four page bulletin 67 describes electric self-balancing indicators and indicating controllers. Explains the operating principles, two or three position control features, applications, and installation procedures. Two models available: potentiometer or bridge. Over 50 ranges and calibrations available. — *Thermo Electric Co., Inc., Saddle Brook, N.J.*

Pneumatic Receiver

Six page bulletin A134 describes unit with a 4 in. chart width. Discusses removable chart-drive mechanism, capillary inking system, and other features. A photo of unit has nomenclature listed. — *The Bristol Co., P.O. Box* 1790, *Waterbury* 20, *Conn.*

Aladdin
AIR HANDLING EQUIPMENT

ROOF VENTILATORS

- THIRTEEN SIZES
- SELF CONTAINED
- QUIET OPERATING

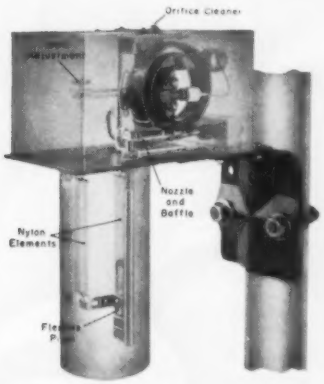
ALADDIN Type V Roof Ventilators are available in a complete range of sizes... direct and belt driven. Units can be furnished in both curb mounted or extended base types. Ruggedly built, the type V units have been designed for those installations where positive year around powered ventilation is required, and when properly installed, will give years of efficient trouble free service.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

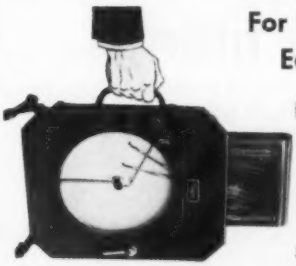
NEW from *Taylor* FOR RELATIVE HUMIDITY

When Transmission Is Necessary



Taylor 207T Relative Humidity Transmitter is a non-indicating, pneumatic, motion-balance instrument. It produces an air putput pressure (3-15 psi) proportional to the relative humidity around the sensing elements, permitting a direct reading in the receiving instrument. Zero setting can be checked against wet and dry bulb hygrometer—adjusted with knurled nut on Bourdon spring take-off arm.

For Portability and Easy Reading



New Taylor 100J Relative Humidity Recorder is actuated by Nylon fibre elements that change in length with variations in moisture content. Magnified by special mechanical linkage, this change in relative humidity is recorded directly on easy-to-read 24-hour chart. There are no conversions to make, no troublesome wicks to change, and accuracy is unaffected by periodic saturation. Weighs only 25 pounds.

Let Taylor solve your measurement or control problems. Ask your Taylor Field Engineer or write for literature.

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MEAN ACCURACY FIRST

STAINLESS
pipe & fittings
in stock...

Stainless steel piping for process installations, like the one pictured in Mogen David Wine Company's modern Chicago plant, can be readily supplied from our warehouse stock.

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6 Warehouses serving the middlewest
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RECENT TRADE LITERATURE

Continued

Canned Pumps

Four page bulletin 1100-1 describes complete line of seal-less pumps for corrosive, toxic, volatile, explosive, radioactive, or other problem fluids. Covers design, operation, and selection. Illustrated with photos, a chart, and a table. — *Fostoria Corp., Chempump Div., Huntington Valley, Pa.*

Cabinet Blowers

Six page bulletin CB-61 gives data on cabinet blowers that filter, heat, cool, humidify, and circulate air. Seventeen models available ranging from 1000 to 24,000 cfm. Line drawings provide application data; charts give dimension data. — *Air Dynamics, Inc., 9742 Klingerman St., South El Monte, Calif.*

Lubricated Plug Valves

Twelve page bulletin gives pressure drop data on 85 of firm's lubricated plug valves. Enables calculation with either the K-values or equivalent feet method. Data will fulfill most piping requirements. Illustrated with tables, charts, graphs, and photos. — *Walworth Co., 750 Third Ave., New York 17, N.Y.*

Mechanical Power Transmission

Eight page bulletin 23103 gives information on equipment used in mechanical power transmission: V-belts, drives, pulleys, motor bases, flexible couplings, bushings, bearings, pillow blocks, and related equipment. Lists separate bulletin numbers for each product or product line.—*T. B. Wood's Sons Co., Chambersburg, Pa.*

Electronic Testing Equipment

Three catalog sheets describe electronic testing equipment. Sheets have been "Kalamazoo" punched to permit insertion into existing binders. Technical data and application illustrations on each product are organized under standard headings. — *Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, L.I., N.Y.*

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Ewing

Gas Operated Automatic

HOT WATER HEATERS

SPACE-SAVING VERTICAL TYPE!

DESIGNED AND ENGINEERED for the INDUSTRIAL-COMMERCIAL USER

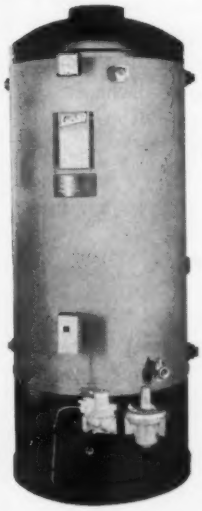
RECOVERY CAPACITIES

Gals. Per Hour 268.8 to 793.8 — Temp. Rise 100 Degrees F.

STORAGE CAPACITY

76 Gals to 217 Gals

4 New Models



HIGHEST QUALITY
1/4 INCH SHELL 3/8 INCH HEAD

AGA AND ASME APPROVED

BURNER ASSEMBLY COMPLETE AND FACTORY INSTALLED

Ewing heaters provide a constant, abundant supply of clear, clean low-cost hot water.

AMERICAN GAS ASSOCIATION APPROVED — COMPLIES WITH NATIONAL SAFETY REQUIREMENTS

USE ANY TYPE GAS

Write, phone or wire for complete data sheets, specifications and prices.

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2545 NW 10 P. O. BOX 875
OKLAHOMA CITY, OKLA.

The complete quality line

SARCO RADIATOR VALVES

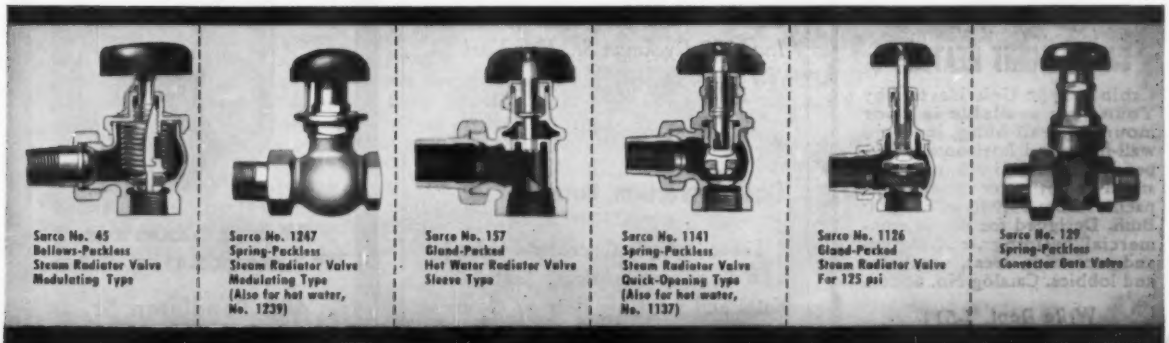
for steam and hot water

Here's one reliable specification for all radiator valve requirements: Sarco.

For steam, Sarco makes the Bellows-Packless, Spring-Packless and Gland-Packed types. For hot water: Spring-Packless and Gland-Packed types. These are supplied in globe, angle and corner patterns; gate type; modulating and quick-opening models. For pressures up to 200 psi.

Write for Bulletins.

7001



Sarco No. 45 Bellows-Packless Steam Radiator Valve Modulating Type

Sarco No. 1247 Spring-Packless Steam Radiator Valve Modulating Type (Also for hot water, No. 1239)

Sarco No. 157 Gland-Packed Hot Water Radiator Valve Sleeve Type

Sarco No. 1141 Spring-Packless Steam Radiator Valve Quick-Opening Type (Also for hot water, No. 1137)

Sarco No. 1126 Gland-Packed Steam Radiator Valve For 125 psi

Sarco No. 129 Spring-Packless Connector Gate Valve

SARCO

SARCO COMPANY, INC.
AN AFFILIATE OF SARCOTHERM CONTROLS, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

Young
BUILDS THE BEST UNIT HEATERS

HORIZONTAL UNIT HEATERS

Type "H" Unit Heaters by Young are available in 15 standard models, for use with steam or hot water systems. Capacities from 19,000 to 325,000 Btuh. One of the most efficient, low-cost space heaters manufactured. Catalog No. 2557A

VERTIFLOW® UNIT HEATERS

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Cabinet Type Unit Heaters by Young are available in floor mounted, wall-hung, inverted wall-hung and horizontally suspended models in 3 sizes for steam or hot water systems. Capacities from 29,900 to 117,300 Btuh. Designed for use in commercial buildings, auditorium and recreation areas, vestibules and lobbies. Catalog No. 6556A

Write Dept. J-511 for Catalog Required.

YOUNG RADIATOR COMPANY
RACINE, WISCONSIN
Plants at Racine, Wis. and Mattoon, Ill.

RECENT TRADE LITERATURE
Continued

Gasket Materials

Twenty-four page booklet AD-190 gives information concerning the various styles of gasket materials available. Material selection, resistance ratings, and design information are three of the many topics discussed. Illustrated with photos and tables. — *Garlock Inc., Palmyra, N. Y.*

Temperature Transmitter

Twelve page bulletin 13-17C describes type "12A" pneumatic temperature transmitter. Features compact construction, forced-balance operation, and automatic compensation for ambient temperature and pressure changes. Includes specifications, descriptions of operating principles, table of temperature ranges, and data on related accessories. — *The Foxboro Co., Foxboro, Mass.*

Flexible Metal "Teflon" Hose

Four page bulletin No. 29 describes bronze wire braided hose containing an inner core of "Teflon." Also gives information on field attachable, reusable brass fittings. Lists applications, common media, construction features, and other information. Illustrated with photos and a table. — *Atlantic Metal Hose Co., Inc.*, 308 *Dyckman St., New York* 34, *N.Y.*

Gas Conversion Burners

Loose-leaf, plastic-coated binder includes specifications, installation data, and servicing data on commercial and industrial gas and dual-fuel conversion burners, gas and oil cast iron boilers, and gas propeller and blower type unit heaters. — *Roberts-Gordon Appliance Corp.*, 44 *Central Ave., Buffalo* 6, *N. Y.*

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PLASTIC Moisture ELIMINATOR BLADES

FOR INDUSTRIAL AIR CONDITIONING ARE

LESS COSTLY TO MAINTAIN

Maintenance costs are less when you specify SOPLASCO plastic Moisture Eliminator Blades. The superior surface reduces to a minimum the possibility of algae and lint accumulation. Cleaning is accomplished without blade removal.

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For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

FOR SIMPLIFIED INSTALLATION

AND COMFORTABLE ROOM HEAT

USE SHAW Panel-Vectors

Shaw Panel-Vectors are of rigid, fully-integrated construction, delivered ready to install. There are no dampers or separate housings to fit and hang. Choice of same end or opposite end tapping offers opportunities for important piping simplification and economies.

Panel-Vectors distribute a *low-temperature*, unvarying combination of radiant and convected heat that only Nature—at her best—can rival. Stratification, and areas of extreme heat or chill are eliminated . . . room occupants are not only warm, they are *comfortably* warm.

Shaw Panel-Vectors use hot water or steam up to 150 psi. They are available in wall-hung (panel) or baseboard models, each a space-saving 3″ deep. There is a full range of sizes to meet any room-heat distribution requirement.

Find out today about Shaw Panel-Vectors—the radiators that give you simplified installation, give the owner *comfortable* heat. Write for free literature on wall-hung and baseboard models.

SHAW PERKINS MFG. CO.

Properly Designed Room Heat Distribution Equipment

201 E. CARSON ST., PITTSBURGH 19, PENNA.

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Here Are 3 Easy ways . . .

- **IF they use more than 45 tons of coal per year . . .**
- **IF they burn more than 6,000 gallons of light oil per year . . .**
- **IF they have more than 1,500 sq. ft. of radiation in your building . . .**

IF any of these conditions prevail, you have a prospective customer — with the opportunity to open up new markets with less competition and more profits!

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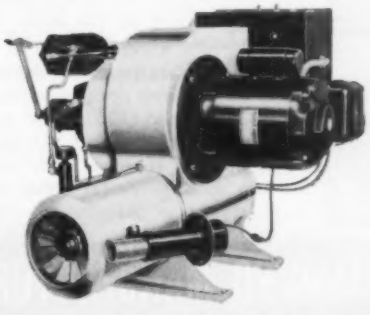
Simply and efficiently designed, the HEV-E-OIL Burner installs as easily as any home burner . . . yet it is engineered to use low-cost, high heat content, heavy fuel oils as well as light oils.

First and only commercial-industrial burner to apply the principle of low-pressure air atomization of heavy fuel oils inside the burner nozzle . . . the HEV-E-OIL Burner is a complete package.

Factory-assembled; full fire-tested; completely wired, with automatic controls connected, tested and mounted on the burner.

HEV-E-OIL Burner meets all code standards; is Underwriters Laboratory approved. Available in 5-150 gph with 720,000-21,000,000 BTU capacity.

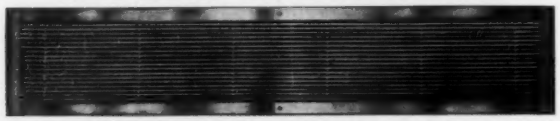
IF you want to find new markets with less competition and more profits, write today to Dept. E91 for complete information on HEV-E-OIL Burners.



INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4447 N. OAKLAND AVE., MILWAUKEE 11, WIS.

LOOK BETTER... LAST LONGER!



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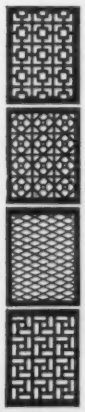

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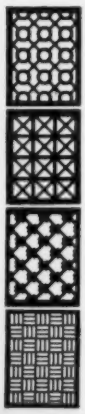


DIAMOND MANUFACTURING CO.
Box 41 WYOMING (Wilkes-Barre Area) PENNA.

WE HEAR THAT...

ROBERT K. MOSS, CONSULTANTS, is the name of a new consulting organization located at 2252 Dehne Rd., Northbrook, Ill. The company will render consultation services to architects and contractors on the problems involved in any type and size of heating or air conditioning project. Robert K. Moss, P. E., is president of the firm.

AMPROBE INSTRUMENT CORP. is the new name of Pyramid Instrument Corp. The name change is in keeping with trade usage.

H. K. PORTER CO., INC. has purchased the *NATIONAL CORNICE WORKS, INC.*, Los Angeles, Calif. The firm is primarily a manufacturer of fans and blowers used for commercial and industrial ventilation.

John R. Watson has been added to the staff of the *MECHANICAL CONTRACTORS INDUSTRY ADVANCEMENT PROGRAM OF GREATER PHILADELPHIA, PA.*, according to William R. Funk, administrator of the group. He will call on architects and engineers to promote closer cooperation and better relationships.

The *MASTER ELECTRIC DIV.* of *RELIANCE ELECTRIC AND ENGINEERING CO.* will move its operations to two new plants in Indiana. One building will be a 210,000 sq ft structure in Columbus, serving as headquarters for the division. The other building will be a 160,000 sq ft structure located in Madison. Both are scheduled for completion this fall.

Martin C. Scanlan has been named production manager of *LIMBACH CO.'s* mechanical department in Boston, Mass. Limbach Co. is a mechanical contracting firm with headquarters in Pittsburgh, Pa.

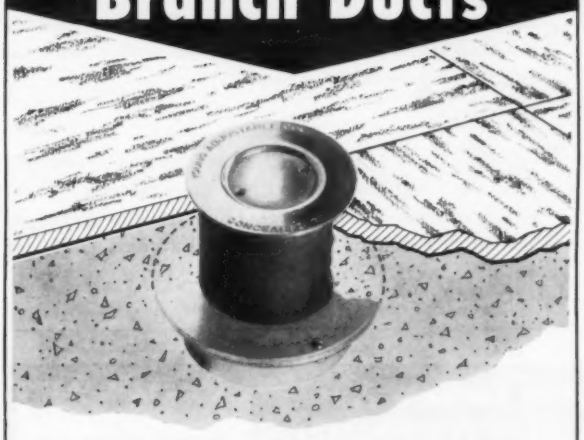
CRANE CO. has formed a new French company, *CIE. CRANE*, with headquarters in Paris. The new company was formed by merging two French valve manufacturers acquired during the past year by Crane.

YORK DIV., BORG-WARNER CORP. will spend more than $500,000 in expanding its engineering research and testing facilities in York, Pa.

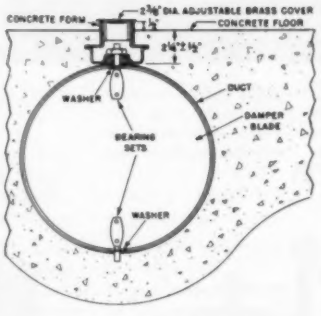
GOLDEN-ANDERSON VALVE SPECIALTY CO. has purchased the former Rotary Valve & Engineering Corp. of Birmingham, Ala. The name of the company has been changed to *ROTARY VALVE CORP.*, and will be operated as a subsidiary of Golden-Anderson.

For a better balanced Perimeter Heating and Cooling System - *install*

YOUNG Floor Line Adjustable Cover Regulators in Branch Ducts



Adjustable Brass Cover screws down flush with floor after form is removed.



The Young No. 330 Regulator, installed in a branch duct, gives *accurate* control of the volume of air to the register.

This is the *sure way* of controlling the required volume of air for individual rooms.

Only 2-3/8" in diameter, the adjustable cover plate fits flush with the floor. Model No. 330 is for installations with up to 2" of concrete above the duct. Other models are available for up to 12" of concrete above the duct.

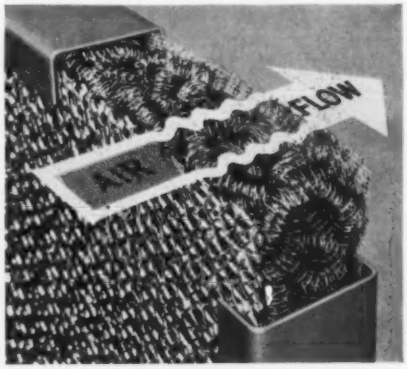
Write for complete catalog or consult Sweet's Architectural File or the Engineer's Product File.

YOUNG REGULATOR COMPANY
20910 Miles Parkway, Cleveland 28, Ohio

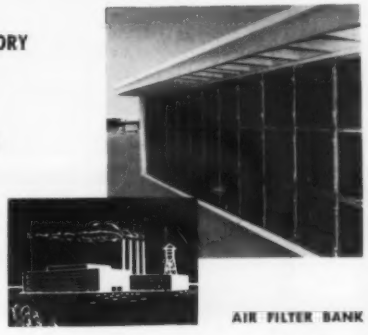
VORTOX AIR FILTERS

DUST AND GREASE

The Coil Springs Tell The Story



SELECTED TERRITORY AVAILABLE FOR QUALIFIED REPRESENTATIVES



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AFI MEMBER AIR FILTER INSTITUTE

WHY SUPERIOR?

- Large dust holding capacity
- Impingement type
- Low pressure drop
- All metal construction
- Uniformity and proper spacing of filaments
- Efficient filtration at high and low air velocities

Specify VORTOX — Air Filters Engineered and Built for a LifeTIME

VORTOX COMPANY

CLAREMONT, CALIFORNIA
(LOS ANGELES AREA)

WE HEAR THAT

Continued

HENNINGSON, DURHAM & RICHARDSON, engineering and architectural firm, has opened an office in Charlotte, N. C. The firm also has purchased all the stock and taken over the practice of Vannort Engineers, Inc. of Charlotte. Robert Southworth has been named manager of the new office.

LINDY HYDROTHERMAL PRODUCTS, INC. has begun construction of a new plant and office building at Provost Ave. and East St. in the Bronx, N. Y. The plant will have 35,000 sq ft of space.

THE YOUNGSTOWN SHEET AND TUBE CO. has licensed the *TUBULAR PRODUCTS DIV.* of *THE BABCOCK & WILCOX CO.* to manufacture and sell welding fittings and other products of "Yoloy" steel.

A ten-man Japanese team, an International Cooperation Administration Group, held a discussion in late July with Harold P. King, president of the national *CONSULTING ENGINEERS COUNCIL,* in regard to the organization, policies, procedures, regulations, and operations of the C.E.C.

WORTHINGTON CORP. recently held their third international air conditioning and refrigeration conference. The corporation met in Hong Kong. Announcements were made of a new addition to be made on Worthington's Japan plant; a replacement for the Argentina facility; and the addition of associates in Egypt, Iran, Brazil, and other countries.

BENJAMIN FOSTER CO. is using a new type apparatus to determine the flame-spread index of insulation coatings. The index is a relative measure of surface spread of flame, or conversely, resistance to burning in any material exposed to heat.

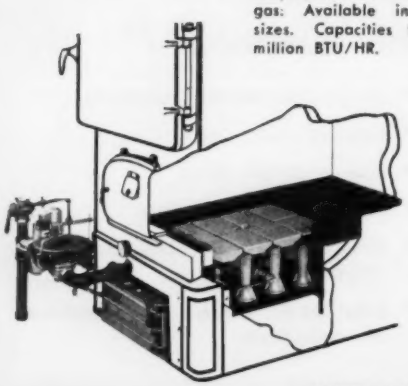
LAWLER AUTOMATIC CONTROLS, INC. has expanded its facilities by acquiring a three story building and parking lot which is adjoining its original building. The addition more than doubles the manufacturing area of the company.

THE FLINTCOAT CO. has been licensed by *JOHNS-MANVILLE CORP.* to manufacturer "Transite" asbestos-cement pipe. Flintcoat now plans to construct a $10 million plant in Ravenna, Ohio, for manufacturing the pipe.

When your "specs" call for ATMOSPHERIC GAS BURNERS . .

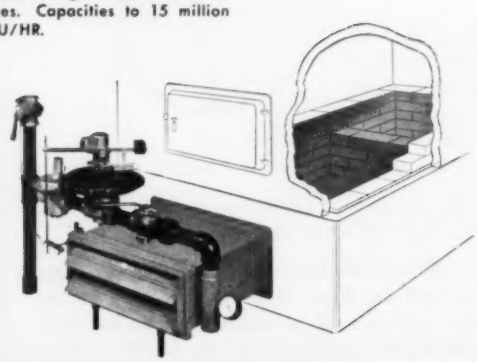
specify Gordon & Piatt PLANNED PERFORMANCE* BURNERS . . .

BLUE LINE flame upshot burner, natural or L-P gas. Available in 45 sizes. Capacities to 8 million BTU/HR.



MAXIMUM EFFICIENCY

TYPE H inshot burner for horizontal flame applications, natural or L-P gas. Available in 30 sizes. Capacities to 15 million BTU/HR.



FLEXIBLE USAGE . . . TROUBLE-FREE

Gordon & Piatt, Inc.
P. O. Box 914
WINFIELD, KANSAS

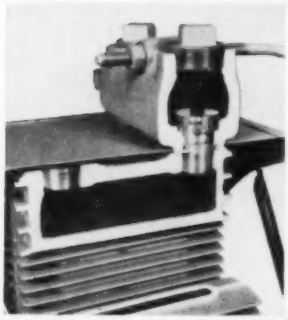
Gordon & Piatt manufactures a complete line of combustion equipment. Forced draft gas, oil, or combination burners • Power gas burners • Control panels and burners for special applications.

*PLANNED — Factory assembled, pre-wired for "Bolt-on" installation.

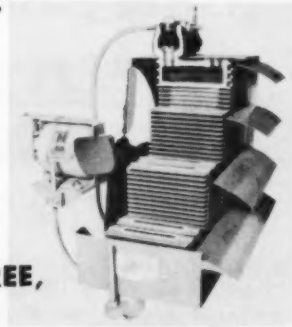
*PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Only With

GRID*



UNIT HEATERS and BLAST HEATERS



*CAN YOU GET MAINTENANCE-FREE, TROUBLE-FREE *Life Long* HEATING SERVICE . . .

It is possible because GRID is made to be maintenance-free, trouble-free . . . installations in 1929 are still operating without repairs. GRID construction and material - inside and out - account for GRID life long heating service.

GRID one piece cast iron steam chambers and headers eliminate internal corrosion . . . There's only one metal in contact with steam. No electrolysis is developed internally to eat away the heating elements. No leaks from rotted cores. And, GRID is leak-proof on steam pressures up to 250 P.S.I. 450° temperature. Specially designed units available for use on super heated steam.

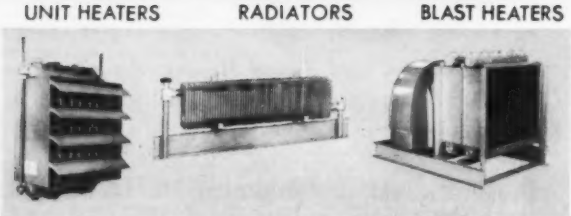
GRID cast iron construction resists corrosion externally from acid fumes or other destructive elements in the atmosphere . . . cannot destroy GRID cast iron fin heating surface. Widely spaced fins cast integral with the steam chamber will not corrode and are easy to clean . . . will not "mat" on air intake side.

For trouble-free heating in your plant, write for complete information on GRID . . . ask for GRID products catalog No. 956.

D. J. MURRAY MANUFACTURING CO

Manufacturers Since 1883 • WAUSAU WISCONSIN

UNIT HEATERS RADIATORS BLAST HEATERS



Here's trouble-free air conditioning the easy Oakite way

End scale, slime and corrosion troubles in air conditioning water with Oakite Airefiner No. 52. All it takes is a ten-minute daily check up by one man. This way you maintain high cooling efficiency and you reduce out-of-service time, too.

How? With a simple four step program. (1) Charge water initially with Oakite Airefiner No. 52. (2) Test water daily. (3) Add upkeep when necessary. (4) Drain system and replace with new, charged water on a periodic basis.

That's all there is to it. Airefiner No. 52 checks slime and algae growth, prevents scale build-up and minimizes corrosion. It leaves tubes clean for efficient heat exchange. It's safe. It's inexpensive.

For explanatory drawings and full details on this time and trouble saving method, ask your local Oakite Technical Service Representative, or write Oakite Products, Inc., 51A Rector Street, New York 6, N. Y.

OAKITE

over 50 years' leadership in industrial cleaning — Est. 1909 — SCIENCE

specialized **WATER TREATING** *materials*

Technical Service Representatives in Principal Cities of U. S. and Canada

QUIET PLEASE!

When silence is the order, this is just one more good reason to specify Cook Ventilators. Compatible all aluminum construction in perfect balance puts a hush on air movement.

Besides meeting your specs for capacity and quiet, Cook Ventilators will help you cut costs.

Check these features:

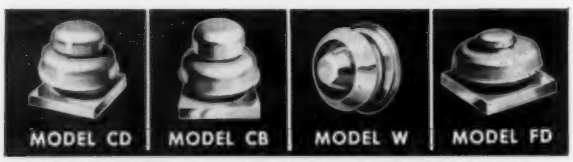
LESS ROOF LOAD—weight cutting all aluminum construction needs less structure for support.

LESS MAINTENANCE—sealed bearings in motors and blowers seldom need lubrication. Aluminum never rusts—never needs paint.

SIMPLE TO INSTALL—designed for easy installation—cuts installation time in half.

NO CALL BACKS—engineered for fool-proof operation . . . install them—forget them.

THE FIRST VENTILATOR
WITH A 5 YEAR WARRANTY



For complete specifications and description of the Cook line, See Sweet's Architectural or mail the coupon.

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Cook ALL ALUMINUM VENTILATORS
THE LOREN COOK COMPANY
BEREA, OHIO MEMBER AMCA

MEETINGS & CONVENTIONS

SEPT. 11-14 — *Air Moving and Conditioning Association.* The Greenbrier, White Sulphur Springs, West Va. Information: Air Moving and Conditioning Association, Inc., 2159 Guardian Bldg., Detroit 26, Mich.

SEPT. 12-14 — *Southeastern Maintenance and Engineering Show.* War Memorial Coliseum, Greensboro, N.C. Information: John Harden Associates, P.O. Box 3173, Greensboro, N. C.

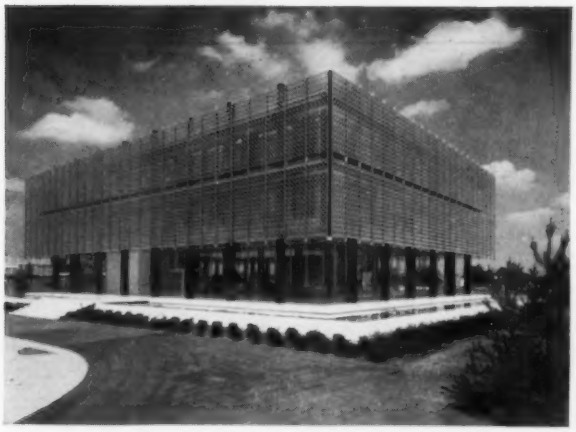
SEPT. 18-20 — *Standards Engineers Society 10th Annual Meeting.* Hotel Sherman, Chicago, Ill. Information: Standards Engineers Society, 170 Livingston Ave., New Providence, N. J.

SEPT. 21-22 — 1961 *Annual Meeting of the East Central Section, Air Pollution Control Association.* Sheraton-Seelbach Hotel, Louisville, Ky. Information: Ralph Bourne, conference chairman, Room 2, City Hall, Louisville, Ky.

SEPT. 25-28 — *American Welding Society Fall Meeting.* Adolphus Hotel, Dallas, Tex. Information: Information Center, American Welding Society, 33 W. 39th St., New York 18, N.Y.

SEPT. 27-*OCT.* 4 — *The Institute of Heating and Ventilating Engineers, International Conference on Heating, Ventilating and Air Conditioning.* London, England. Information: F. L. Rossetti, secretary, Conference Coordination and Management Committee, 49, Cadogan Sq., London, S.W. 1.

OCT. 1-4 — *43rd Annual Meeting, American Gas Association.* Registration, Dallas Municipal Auditorium; various sessions at the Statler Hilton, Sheraton-Dallas, Adolphus, and Baker hotels, Dallas, Tex. Information: American Gas Association, 420 Lexington Ave., New York 17, N. Y.



REYNOLDS METALS SELECTS

LO-BLAST

POWER GAS BURNERS

FOR FUEL ECONOMY... DEPENDABILITY ...LOW MAINTENANCE

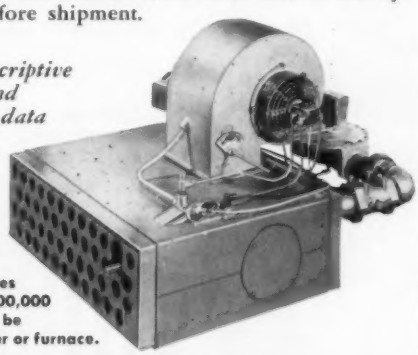
To provide gas absorption cooling as well as heating in the dramatic new Reynolds Metals building, a Lo-BLAST Power Gas Burner was selected as the simplest, most economical way to fire the steam boiler. Low installation and maintenance cost were other reasons for the choice.

Lo-BLAST Burners save money because they eliminate the fuel waste caused by uncontrolled draft. These power-type burners provide a constant, metered supply of both air and gas regardless of varying draft conditions. Perfect combustion at all times is the result.

Both primary and secondary combustion air is supplied by a small, quiet blower only when the burner is on. When the burner stops, the flow of air shuts off. The heating plant thus retains much of its heat between operations.

Lo-BLAST Burners eliminate the need for high chimneys—"inshot" design and complete factory assembly reduce installation and maintenance costs. Each unit is factory-tested on gas before shipment.

Send for descriptive literature and engineering data



Lo-BLAST and Economite Power Gas Burners are available in capacities from 75,000 to 20,000,000 BTU input. They can be installed in any boiler or furnace.

MID-CONTINENT
METAL PRODUCTS COMPANY
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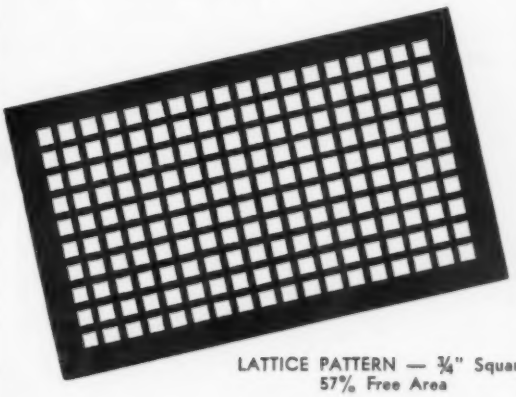
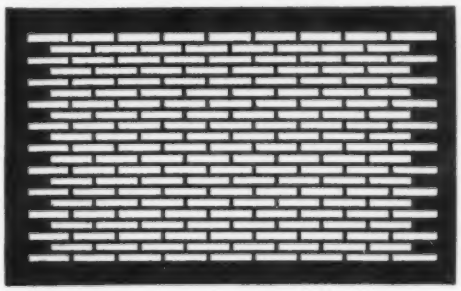
Architectural Grilles

for every type of installation

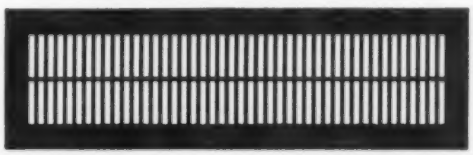


LATTICE PATTERN — ¾" Square
57% Free Area



DESIGN C
73% Free Area

Getting exactly what you want is no problem when you specify A-J Architectural Grilles. There are practically no limitations on size and grilles can be made to your exact order from steel, aluminum, bronze, monel or stainless. Available in slotted designs B, C and D, and square meshes of ½", ⅜", ¾", 13/16" and ⅞".



NEW FROM A-J! Design E Convector-type grille with vertical pencil-proof slots for cooling or heating outlets, return or exhaust application. Free area 54%. May be installed in sills, sidewalls, ceilings or floors. Available in steel, aluminum, stainless or bronze.

Send for FREE A-J Catalog that contains complete specifications.

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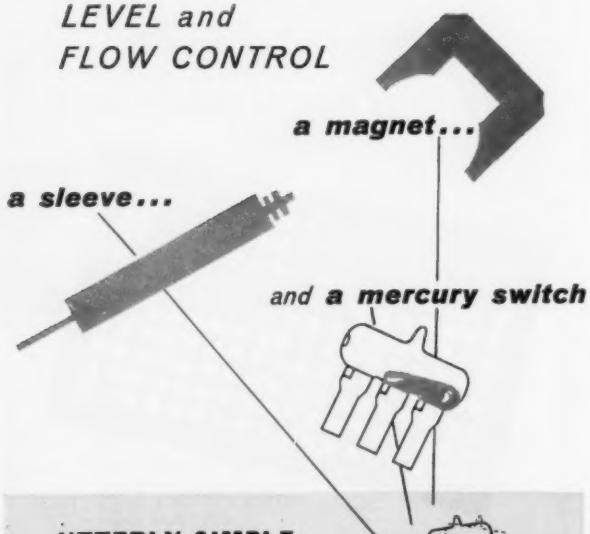
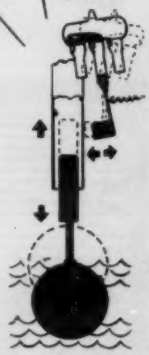
LIQUID
LEVEL and
FLOW CONTROL



UTTERLY SIMPLE

3 unfailing elements safeguard critical liquid level or flow

A **sleeve**, raised and lowered within a nonmagnetic tube as liquid level or flow rates change, attracts or releases a permanent magnet attached to a **mercury switch** outside the tube. That's all there is to it.



MAGNETROL

These three simple elements—the heart of Magnetrol—outmode all bellows, packing glands, and electrodes. Unfailing actuation, as dependable as the pull of a magnet, eliminates all wearing parts and maintenance; nothing to go wrong.

Magnetrols operate indefinitely to protect the critical level or flow of almost **any** liquid, at virtually **any** temperature or pressure. They are so simple that a change in material is usually all that is needed to adapt standard units to any specific application. "Special" Magnetrols are rare.

Magnetrols are available for controlling liquid level changes from ¼" to 150' and more with single or multi-stage switching; flow switches to signal start, stop or insufficient flow within fractions of gpm rates.

Fill in coupon and attach to your letterhead for full information.

MAGNETROL, Inc., 5322 Belmont Road, Downers Grove, Ill. 16

Please send me catalog data and full information on Magnetrol

☐ Liquid Level Controls ☐ Flow Controls

Name_____

MEETINGS & CONVENTIONS

Continued

OCT. 2-3 — *Engineers' Council for Professional Development 29th Annual Meeting.* Sheraton-Seelbach Hotel, Louisville, Ky. Information: Engineers' Council for Professional Development, 29 W. 39th St., New York 18, N. Y.

OCT. 7-10 — *Western Building Industries Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: Western Building Industries Exposition, 2216 S. Hill St., Los Angeles 7, Calif.

OCT. 9-11 — *Technical Committee on Cooling Water Problems, North Central Regional Meeting of the National Association of Corrosion Engineers.* Chase Park Plaza Hotel, St. Louis, Mo. Information: Otto H. Fenner, Monsanto Chemical Co., 1700 S. 2nd St., St. Louis 4, Mo.

OCT. 13-15 — *Refrigeration and Air Conditioning Contractors Association National Board of Directors Meeting.* Hotel Riviera, Las Vegas, Nev. Information: Joseph L. Koach, executive director, Refrigeration and Air Conditioning Contractors Association, 20 N. Wacker Dr., Suite 2265, Chicago 6, Ill.

OCT. 16-17 — *International Conference on Air Ionization.* Franklin Institute, Philadelphia, Pa. Information: American Institute of Medical Climatology, 1618 Allengrove St., Philadelphia 24, Pa.

OCT. 16-20 — *National Safety Council Annual Convention.* Industrial sessions will be held in various hotels, Chicago, Ill. Information: National Safety Council, 425 N. Michigan Ave., Chicago, Ill.

OCT. 19-20 — *Institute on Preparing Construction Contracts and Specifications.* University of Wisconsin, Madison, Wis. Information: Edward O. Busby, 3040 Stadium, The University of Wisconsin, Extension Div., Madison 6, Wis.

Centridyne BY WESTERN

RATINGS AMCA

The new compact centrifugal roof ventilator. Advanced styling as low as 11½"

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Designed by hot water specialists!

Whitlock Convertors and Instantaneous Heaters are designed for top performance, with specific functional advantages to minimize installation and maintenance costs or to extend equipment life.

We will gladly assist you with any water heating problems . . . ask us for suggestions or illustrated bulletins.

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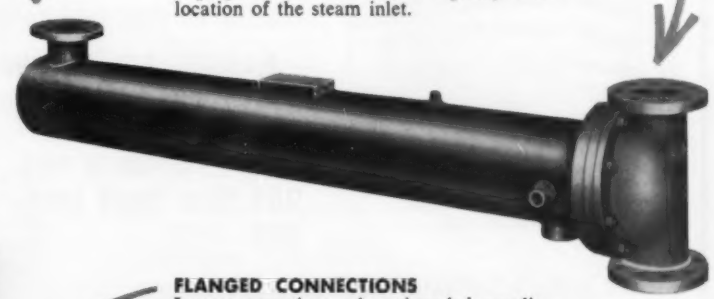
SIDE OUTLET WATER CONNECTIONS
All water piping is out of the way when outlet connections are at the side; tube bundle can be readily withdrawn without disturbing the installed piping.

STEAM INLET LOCATION
By positioning the steam inlet beyond the tube bundle at the rear of the shell, the steam velocity is ¼ to ⅓ of that in the line and cutting of the tubes by steam impingement is eliminated. Specify this location of the steam inlet.



FLANGED CONNECTIONS
Large connections, when *threaded*, are disliked by consulting engineers, cursed by contractors who must fit up to them, and detested by users who must try to keep them tight. Whitlock's large connections are always *flanged* — easy to install — easy to maintain.

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

MEETINGS & CONVENTIONS

Continued

OCT. 23-26 — 1961 *Conference and Exhibition of the South Central Region of the National Association of Corrosion Engineers.* Shamrock Hilton Hotel, Houston, Tex. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

OCT. 25 — *Society for Nondestructive Testing Utilities Committee Fall* 1961 *Meeting.* Cobo Hall, Detroit, Mich. The conference is part of the annual fall meeting program held by the Society for Nondestructive Testing concurrently with meetings of the American Society for Metals, the American Institute of Mining and Metallurgical Engineers and Metal Show.

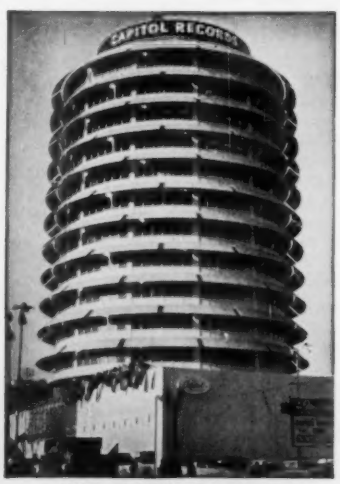
OCT. 29-31 — *Fall Meeting of the Fluid Controls Institute, Inc.* Hotel Hershey, Hershey, Pa. Information: Fluid Controls Institute, Inc., P.O. Box 667, Pompano Beach, Fla.

NOV. 1-3 — *Consulting Engineers Council Semi-Annual Meeting.* Golden Gate Hotel, Miami Beach, Fla. Information: Larry Spiller, executive secretary, 322 Reisch Building, Springfield, Ill.

NOV. 7-10 — *National Warm Air Heating and Air Conditioning Association Annual Convention.* La Salle Hotel, Chicago, Ill. Information: National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14, Ohio.

NOV. 12-15 — *Air-Conditioning and Refrigeration Institute Annual Meeting.* The Homestead, Hot Springs, Va. Information. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 13-17 — *American Public Health Association, 89th Annual Meeting, Air Pollution Session,* Cobo Hall, Detroit, Mich. Information: American Public Health Association, 1790 Broadway, New York 19, N.Y.



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24"

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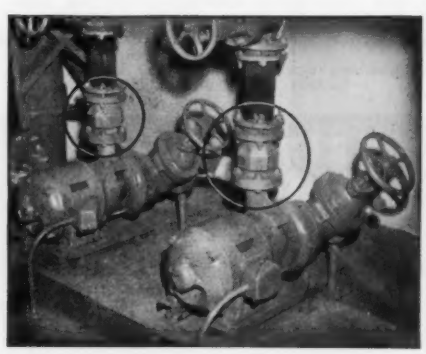

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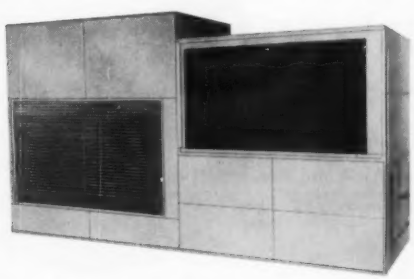

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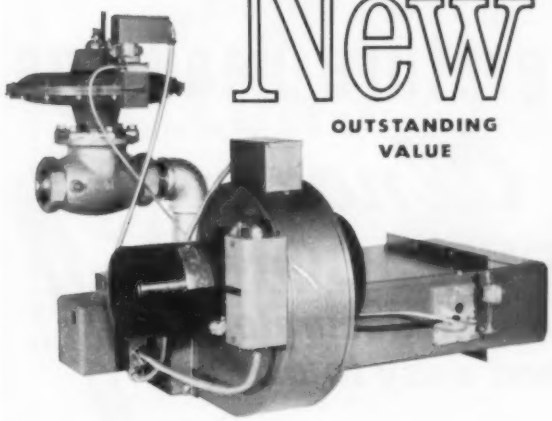

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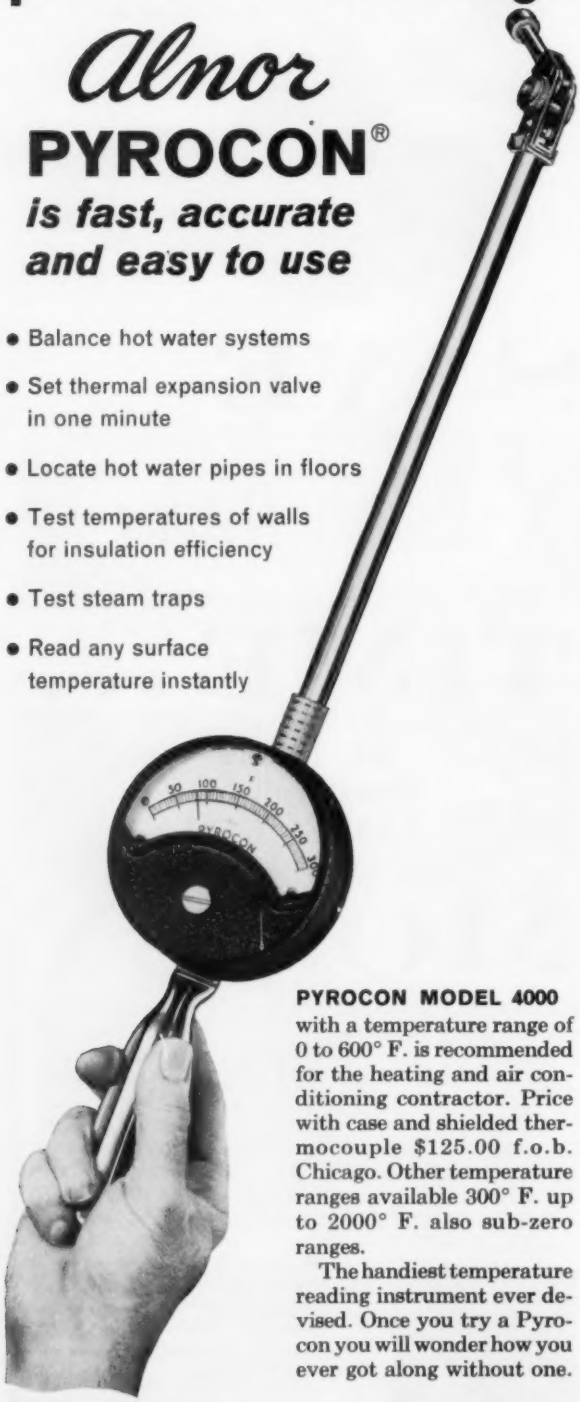

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MEETINGS & CONVENTIONS

Continued

NOV. 26-*DEC.* 1 — *The American Society of Mechanical Engineers Winter Annual Meeting.* Statler Hilton Hotel, New York, N.Y. Information: L. S. Dennegar, director of public relations, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N.Y.

1962

JAN. 22-25. — *Plant Engineering and Maintenance Conference and Show.* Convention Hall, Philadelphia, Pa. Information: Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

JAN. 28-31 — *American Society of Heating, Refrigerating and Air-Conditioning Engineers Semi-Annual Meeting.* Chase-Park Plaza Hotel, St. Louis, Mo. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 234 Fifth Ave., New York 1, N.Y.

FEB. 12-15 — *Air-Conditioning and Refrigeration Industry* 12*th Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: George E. Mills, Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

MARCH 19-21 — *Second National Electric Comfort Heating Exposition, National Electrical Manufacturers Association.* Sherman Hotel, Chicago, Ill. Information: National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N.Y.

MARCH 19-23 — *National Association of Corrosion Engineers Annual Conference and* 1962 *Corrosion Show.* Kansas City Auditorium and Muehlebach Hotel, Kansas City, Mo. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

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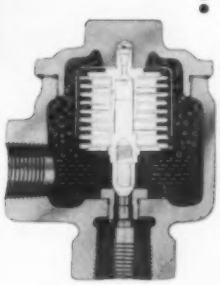

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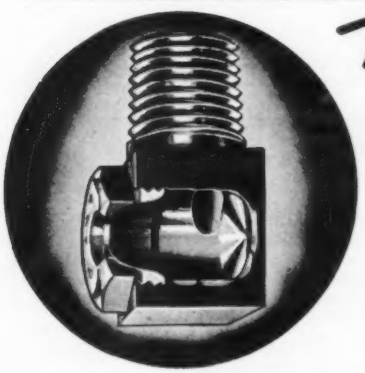

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MEETINGS & CONVENTIONS

Continued

APRIL 25-29 — *Western Space Age Industries and Engineering Exposition.* Cow Palace, San Francisco, Calif. Information: Lykke-Wilkin & Associates, 681 Market St., San Francisco 5, Calif.

MAY 8-11 — *Mechanical Contractors Association of America 73rd Annual Meeting.* Sheraton Hotel, Philadelphia, Pa. Information: Mechanical Contractors Association, 45 Rockefeller Plaza, New York 20, N.Y.

NEW BOOKS & REPORTS...

Automatic Control of Heating and Air Conditioning, Second Edition — Presents the fundamentals, selection, and application of automatic control as it is applied in the heating, ventilating, air conditioning, and refrigeration fields. The 375 page book first introduces basic principles, illustrating them by giving the construction and characteristics of representative control devices. It then shows how to combine individual control devices into control systems. The author is John E. Haines, vice president of Minneapolis-Honeywell Regulator Co. and past president of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers. Price, $10.50. — *McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N.Y.*

Solution Thermodynamics for Absorption Refrigeration (Catalog No. 5/ACR) — A new study by the AGA of the relationship between chemical structure and efficiency of the absorption-refrigeration cycle is reported in this publication. The aim of the project was to investigate the influence of chemical structure on thermodynamic properties as vapor pressure, heat capacity, and the activity coefficients of solutions. The study was conducted by Professor Donald H. Andrews and Raymond A. Rousseau of John Hopkins University, and was sponsored by the AGA Task Group for Air Conditioning Research. Price, $1.50. — *American Gas Association, Order and Billing Department, 420 Lexington Ave., New York 17, N.Y.*

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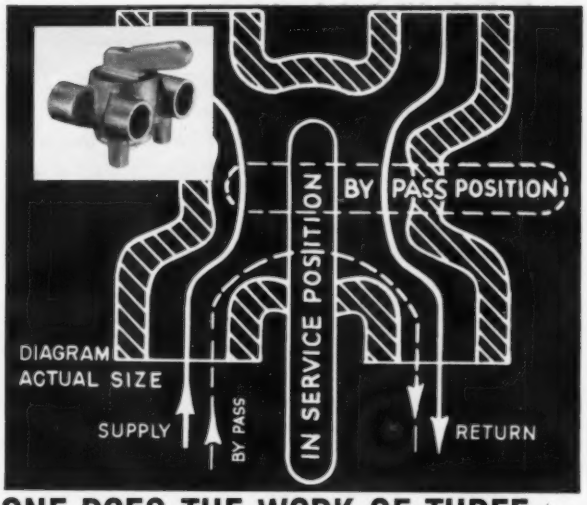

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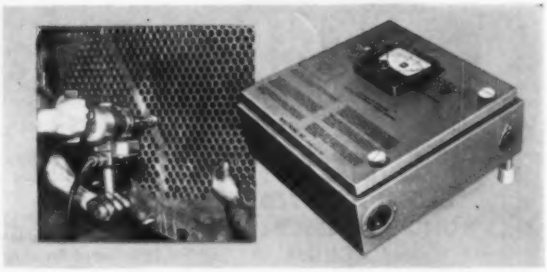

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Continued

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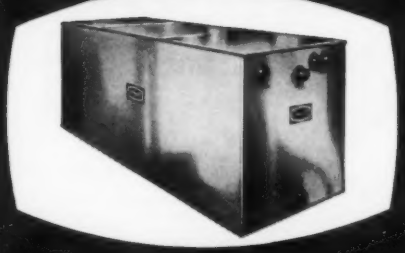
Air Conditioning Systems for Other Than Residences, NFPA No. 90A — Revised standard covers installations of non-residence type air conditioning and ventilating systems. Stiffer requirements are now required for combustibility of linings, coverings, and insulations. Also, the revised standard includes a requirement for a damper in ducts piercing enclosures for vertical openings. The standard was prepared by NFPA Committee on Air Conditioning. Price, 60 cents. — *National Fire Protection Association,* 60 *Batterymarch St., Boston* 10, *Mass.*

Styrene-Rubber Plastic Drain and Sewer Pipe and Fittings, Commerical Standard CS 228-61 — This revised Commercial Standard covers requirements and methods of test for materials, dimensions, workmanship, chemical resistance, crushing strength, water resistance, dimensional stability, and joint tightness of styrene-rubber plastic pipe and fittings. A form of marking to indicate compliance with this standard is also included. The revision was initiated by The Society of the Plastics Industry, Inc., and has been endorsed by a representative cross-section of the industry. Price, 10 cents. — *Superintendent of Documents, U.S. Government Printing Office, Washington* 25, *D.C.*

List of ASTM Publications — A 62 page list of publications describes the symposiums, manuals, special publications, indexes, compilation of standards, charts, reference photographs, and reports published by the American Society for Testing Materials through the years. More than 300 items are fully described, 40 of which are new and not previously listed. Publications cover all phases of materials and their evaluations, and are arranged by title and subject. — *American Society for Testing Materials,* 1916 *Race St., Philadelphia* 3, *Pa.*



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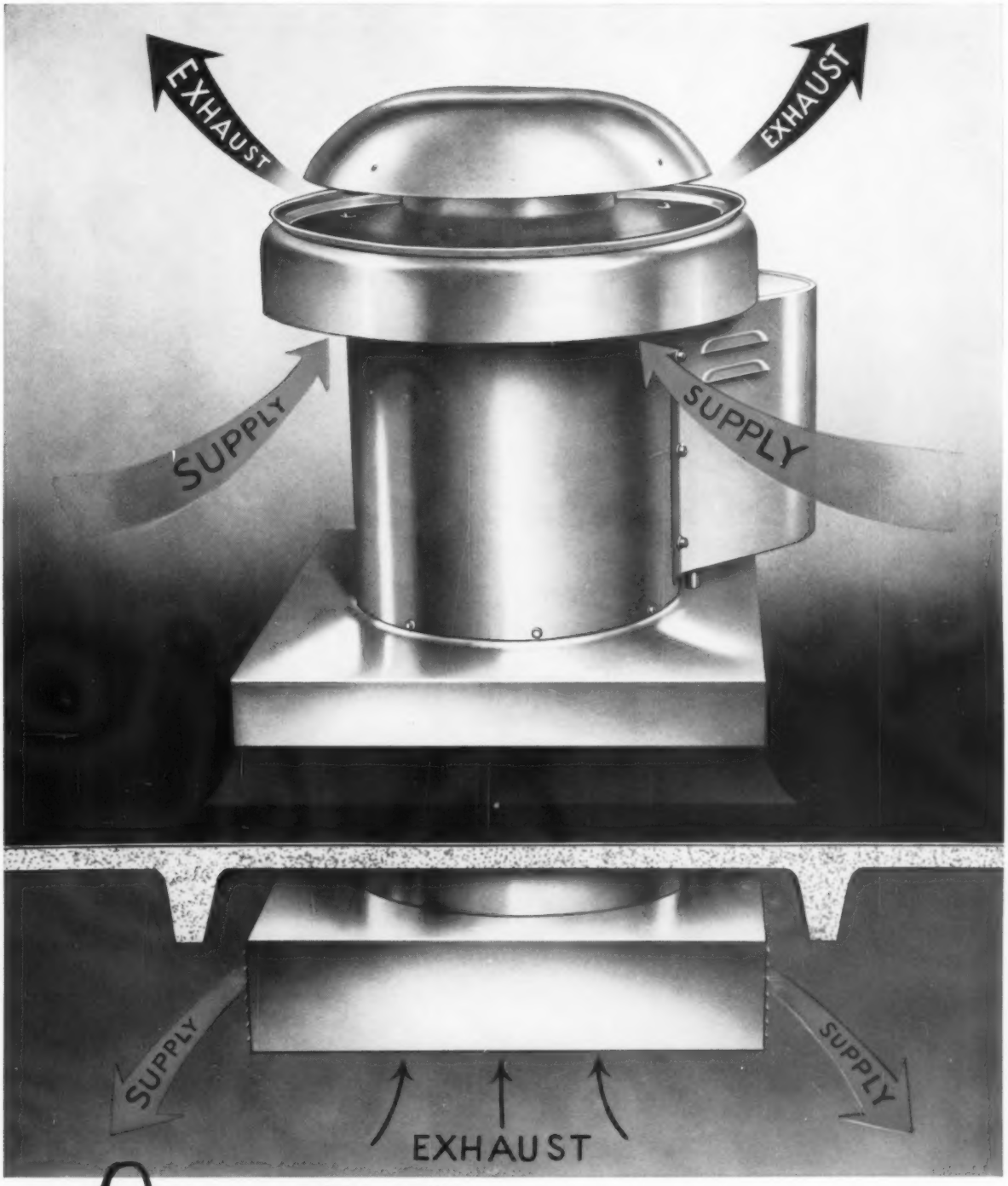

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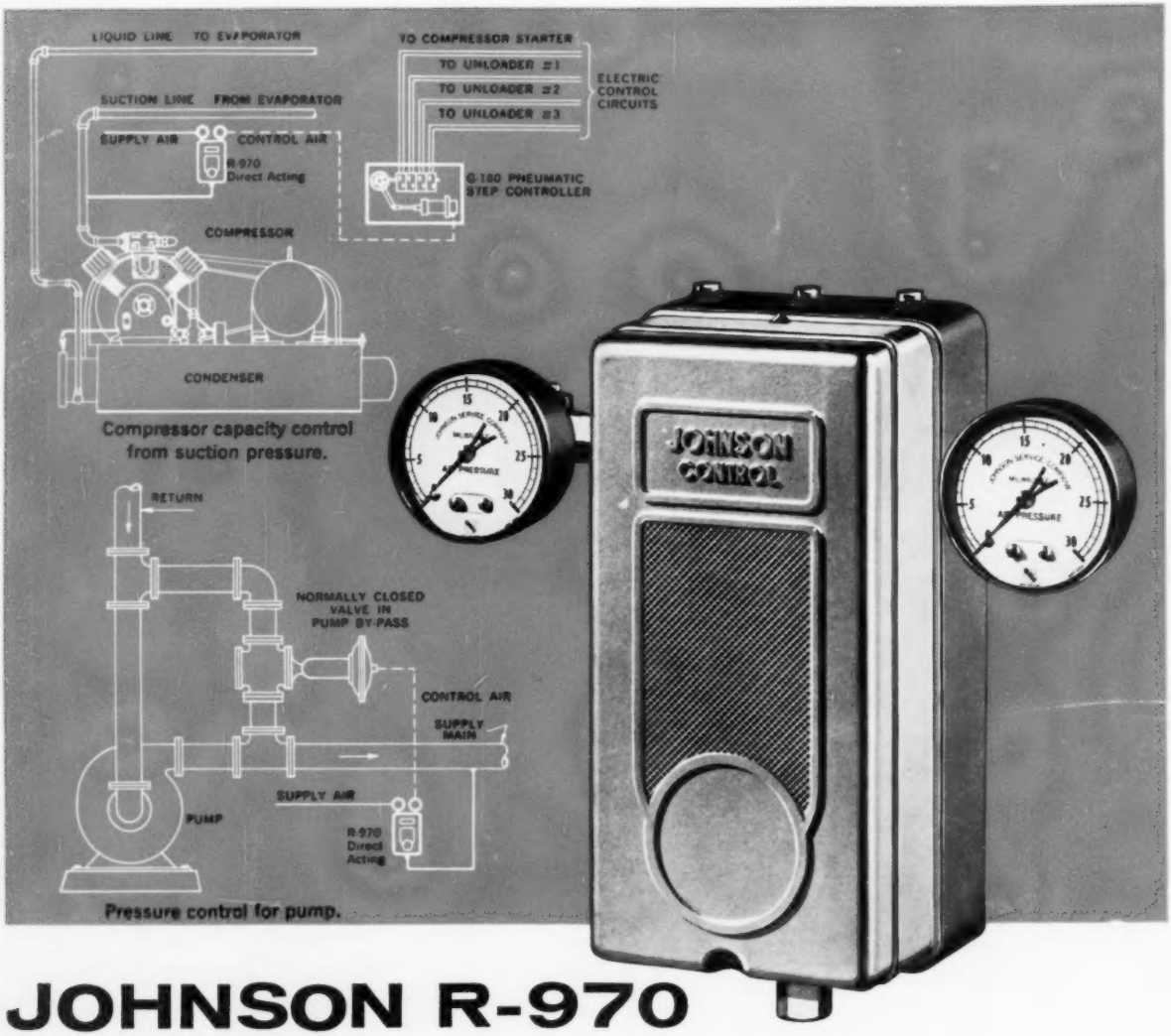

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